ZooKeys 1216: 173–200 (2024)
DOI: 10.3897/zookeys.1216.129923

Research Article

Revision of the genus *Digonis* (Lepidoptera, Geometridae): new species and new genera

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Abstract

The taxonomic study of the Chilean Ennomini genera is still in its early stages. Within this group, the maculation patterns of Chilean species are uniform and often inadequate for distinguishing between many species, compounded by a lack of taxonomic revisions focused on the genera within the tribe. In this study, the genus *Digonis* Butler, 1882, is reviewed and redefined based on characteristics of wing patterns and genitalia. *Digonis* comprises the following five species: *D. aspersa* Butler, 1882, *D. cervinaria* (Blanchard, 1852), *D. punctifera* Butler, 1882, *D. gungnir* Ramos-González & Parra, **sp. nov**., and *D. apocrypha* Ramos-González & Parra, **sp. nov.** Additionally, *D. cuprea* Butler, 1882 is synonymized with *D. cervinaria* (Blanchard, 1852), and all varieties of *D. punctifera* Butler, 1882, and *D. cuprea* are synonymized with their respective species. Furthermore, two new genera are introduced: *Phasmadigonis* Ramos-González & Parra, **gen. nov.,** erected for *P. alba* (Butler, 1882), **comb. nov.**, and *Gugnelve* Ramos-González & Parra, **gen. nov.**, established for *G. butleri* Ramos-González & Parra, **sp. nov.** With the species and genus descriptions, a comparative diagnosis, genitalia illustrations for all species, and wing venation for each genus are provided.

Key words: Andean Region, Argentina, Chile, Ennominae, Ennomini, Nacophorini, taxonomy

OPEN ACCESS

Academic editor: Axel Hausmann
Received: 27 June 2024
Accepted: 27 September 2024
Published: 24 October 2024

ZooBank: https://zoobank.org/1BBB8E67-1398-4D4F-B9CE-B56B2B7A471C

Citation: Ramos-González MI, Venegas-González MF, Zamora-Manzur C, Parra LE (2024) Revision of the genus *Digonis* (Lepidoptera, Geometridae): new species and new genera. ZooKeys 1216: 173–200. https://doi.org/10.3897/zookeys.1216.129923

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Introduction

Ennominae is the most diversified subfamily, comprising approximately half of the described species within Geometridae (Gaston et al. 1995; Scoble 1999; Pitkin 2002; Scoble and Hausmann 2007; Rajaei et al. 2022). However, due to this extensive diversity (approximately 10,000 species), the taxonomic classification at the tribal level has remained in constant flux, and there is still no consensus on the taxonomic affinities of the recognized tribes, particularly when considering taxa from the New World (Holloway 1993; Scoble 1995; Pitkin 2002; Beljaev 2006; Õunap et al. 2011; Brehm et al. 2019).

The most diverse tribes within the Chilean Ennominae, which are also better studied, correspond to Odontoperini with almost 50 species (Rindge 1973,

1983; Parra and Henriquez-Rodriguez 1993; Pitkin 2002; Brehm et al. 2019), and Diptychini with approximately 40 species (Rindge 1986; Parra 1999a, 1999b; Pitkin 2002; Parra et al. 2010; Parra and Hernández 2010; Brehm et al. 2019). In contrast, there have been few taxonomic studies conducted on the other tribes (e.g., Gnophini: Parra and Vargas 2000; Macariini: Vargas et al. 2005, 2020; Boarmiini: Vargas 2007, 2021; Nacophorini: Rindge 1973, 1983; Parra 2018; Ennomini: Bocaz et al. 2016). Therefore, there is a great uncertainty regarding the monophyly of many genera and their position in the systematics of the group (Hausmann and Parra 2009; Brehm et al. 2019).

The tribe Ennomini is characterized by having a vinculum divided ventrally by a membranous area, a paired m3 muscle inserted distally in the median invagination in the basal portion of the juxta. Among Chilean genera of Ennomini, there is notable variability in wing maculation patterns, which has posed challenges in correctly recognizing species. This is exemplified in genera such as *Syncirsodes* Butler, 1882 (Bocaz and Parra 2005; Bocaz et al. 2016), *Hasodima* Butler, 1882 (Parra and Pascual-Toca 2003; Parra et al. 2009), *Perusia* Herrich-Schäffer, 1855 (CZ-M, unpublished data), and *Digonis* Butler, 1882.

Digonis was described by Butler (1882) based on the wing shape and the simple antennae of adults. The forewings exhibit a very acute apex, followed by a concave outer margin that extends to vein M_3, where it terminates in a new acute angle, giving the wings the appearance of having two pointed extensions along their outer margin (Pitkin 2002).

Scoble (1999) recognized five species within *Digonis*: four originally described by Butler (1882): *D. aspersa*, *D. alba*, *D. punctifera*, including the varieties *maculosa*, *acuminata*, *terranea*, and *fumosa*, and *D. cuprea*, including the varieties *olivacea* and *fusca*. Additionally, Scoble (1999) included one species, *D. cervinaria* (Blanchard, 1852). Subsequently, in his review of neotropical Ennominae genera, Pitkin (2002) identified the species comprising the genus as *D. aspersa*, *D. cervinaria*, *D. cuprea*, and *D. punctifera*, excluding *D. alba* due to significant differences in male genitalia.

Despite the general characterization of the genus provided by Pitkin (2002), uncertainty still needs to be resolved surrounding the validity of the described species and varieties. The maculation patterns are deceptively uniform and insufficient for species recognition (e.g., Hausmann and Parra 2009). Therefore, the aim of this contribution is to characterize the genus *Digonis* through a taxonomic revision based on external morphology and genital structures. To achieve this, we redescribe the genus *Digonis*, presenting its diagnostic characters; we provide an illustrated and annotated systematic species list, along with new taxonomic changes, and describe two new genera and three new species.

Materials and methods

This study was based on 107 adult specimens deposited in the collections mentioned below. The type material examined for each taxon is specified in the Results section.

NHMUK	The Natural History Museum, London (UK)
MNHN	Muséum National d'Histoire Naturelle, Paris (France)
MNNC	Museo Nacional de Historia Natural, Santiago (Chile)

MHNC	Museo de Historia Natural de Concepción, Concepción (Chile)
MZUC-UCCC	Museo de Zoología de la Universidad de Concepción, Concepción (Chile)
ZSM	Zoologische Staatssammlung München, Munich (Germany)

For specimen identification and comparison, we used the original descriptions and type material when available. Adult specimens were externally photographed using a Sony Cybershot DSC-HX300 compact camera. Wing and genitalia slides were prepared following the methods outlined in Parra (1991). Nomenclature for genitalia and external characteristics followed Klots (1970) and Scoble (1995), respectively. All prepared slides were photographed using a Motic SMZ-171-TL trinocular stereoscopic microscope equipped with a 5-Mpx Moticam Motic2500 digital camera. These photographs were then used to create detailed illustrations of the microscopic preparations.

Information on the flight period and species distribution was obtained from the labels accompanying each examined specimen. This information was supplemented with records from the citizen science platform iNaturalist (https://www.inaturalist.org). All iNaturalist records cited were identified by the first author as part of the "Polillas de Chile" project (https://inaturalist.mma.gob.cl/projects/polillas-de-chile).

All species were assigned to the biogeographical provinces proposed by Morrone (2015). The newly described genera were diagnosed through comparison with the type species of other closely related genera in the region, based on both external and internal morphological similarities.

Results

Taxonomy

Tribe Ennomini Duponchel, 1845

Digonis Butler, 1882

Digonis Butler, 1882: 360; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248.

Type species. *Digonis aspersa* Butler, 1882. By original designation.

Diagnosis. *Digonis* resembles *Digonodes* Warren, 1895, *Gonogala* Butler, 1882, and the newly proposed genus *Phasmadigonis* gen. nov. particularly due to the mucronate shape of the wings. However, it is distinguished from *Digonodes* by the presence of a mucronate outer margin on the M_3 of the hindwings and the presence of filiform (not bipectinate) antennae. It is recognized as distinct from *Gonogala* by the absence of bipectinate antennae and M_2 in the hindwings. It differs from *Phasmadigonis* by the presence of two accessory areoles in the forewings, R_2 arising from R_{3+4}, and the absence of a vein connecting $Sc+R_1$ to the discal cell in the hindwings. The monophyly of *Digonis* is supported by the following genital characters: a U-shaped gnathos with a plate or a pair of denticulate lobes, a concave, sclerotized process on the costa with an extended cucullus, a furca armed with spines, an aedeagus without cornuti, and a strongly denticulate annular signum.

Redescription. Antennae serrate in males and filiform in females. Thorax and abdomen with brown to grayish scales. Forewings castaneous yellowish, gray, brown, or coppery; costal margin in the apical area slightly arched; outer margin concave between apex and M_3 vein. Wing venation (Fig. 1). Two accessory cells; Sc in contact with first accessory cell, R_1 originates near apex of second accessory cell, R_{2+3+4} from apex of second accessory cell, R_3 and R_4 stalked, R_5 terminates at termen; M_2 equidistant between M_1 and M_3, M_3 slightly arched and ending in small mucronate apex; CuA_1 originates 1/10 before end of cell, CuA_2 originates near the midpoint of the cell. Hindwings paler than forewings, with multiple dark brown scattered spots; medial band conspicuous or faint; outer margin slightly mucronate. $Sc+R_1$ in contact with radial stem up to middle of cell, Rs originates 1/10 before end of cell, M_2 absent. Male genitalia with conical uncus; gnathos "U" shaped, with a pair of prominences or a denticulated plate; subrectangular valvae with a strong sclerotized and concave costal process; spiny furca; aedeagus unarmed. Female genitalia with subpyriform corpus bursae, annular and strongly denticulated signum.

Distribution. This genus is distributed between latitudes 30°S and 47°S, spanning the provinces from Elqui to Capitán Prat in Chile.

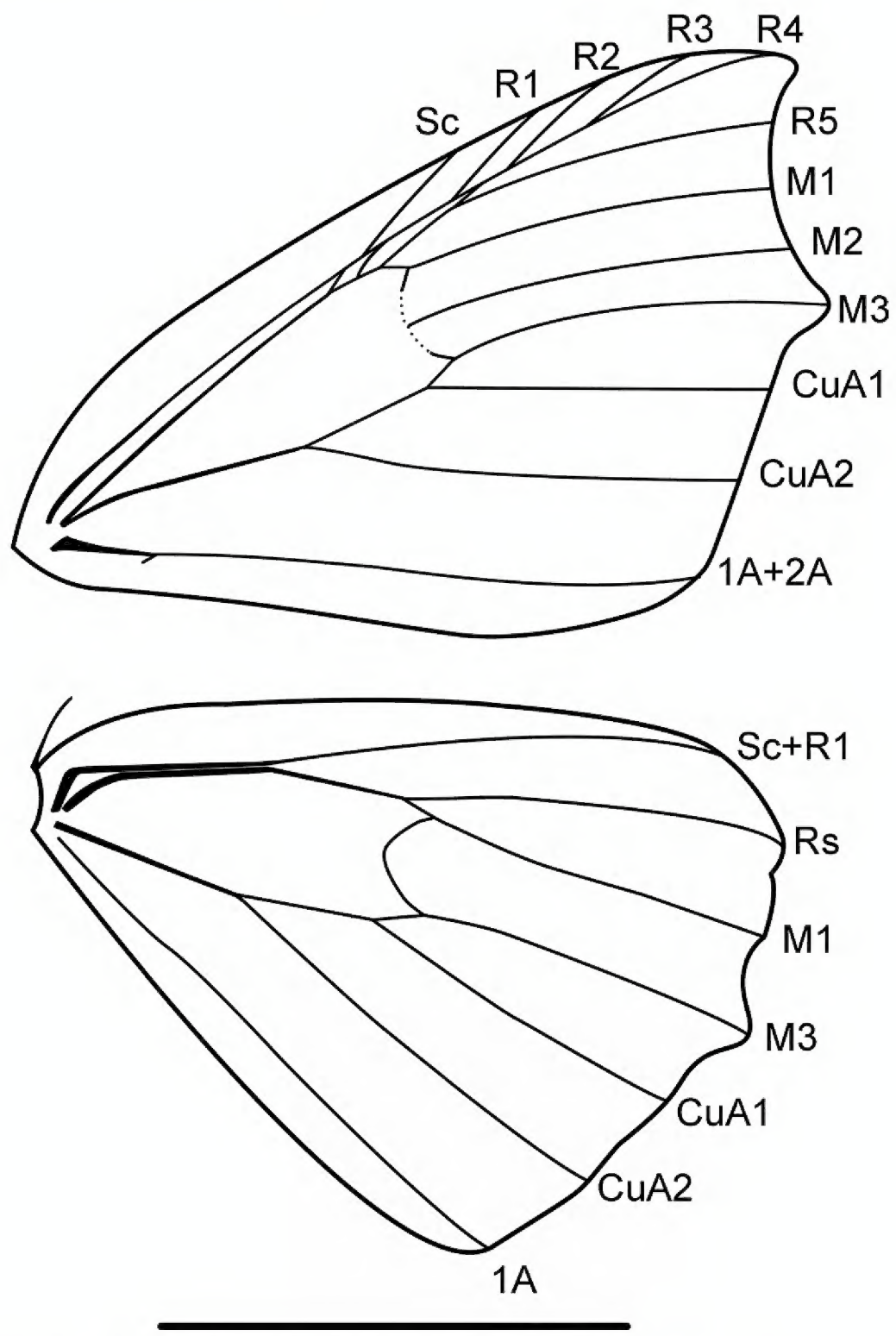

Figure 1. Wing venation of *Digonis* Butler, 1882. Scale bar: 10 mm.

Digonis aspersa Butler, 1882

Figs 2A–D, 3

Digonis aspersa Butler, 1882: 361; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248.

Material examined. *Syntype*. CHILE • 1 male; Pines Valley; "XII" [labeled]; "Chili, 82-107" [labeled]; "Type" [red labeled]; T. Edmonds leg.; NHMUK.

Other material examined. CHILE — **San Antonio Prov.** • Algarrobo; 10-I-1950; n.n. leg.; MZUC-UCCC. — **Diguillín Prov.** • 1 male; Ninhue; 19-IV-2011; G. Moreno leg.; MZUC-UCCC • Las Trancas; III-2013; -36.889694, -71.471611; "Mirg-006" [genitalia slide]; MZUC-UCCC • Las Trancas; 16-IV-2010; G. Moreno leg.; "UCCC-MZUC-Lep 0258" [Museum ID]; MZUC-UCCC • 1 female; Las Trancas; 8-II-2011; G. Moreno leg.; "UCCC-MUZ-Lep-1056" [Museum ID]; "Mirg-022" [genitalia slide]; MZUC-UCCC • Las Trancas; 20-I-2012; G. Moreno leg.; "UCCC-MZUC-Lep 0377" [Museum ID]; MZUC-UCCC. — **Concepción Prov** • 2 males; Concepción; 8-I-2001; J. Artigas leg.; MZUC-UCCC • 1 male; Concepción, Cerro Caracol; 15-II-2001; J. Artigas leg.; "Mirg-003" [genitalia slide]; MZUC-UCCC • 1 male; Concepción, Cerro Caracol; 30-II-2002; J. Artigas leg.; MZUC-UCCC • 1 male; Concepción; 3-II-1960; Trampas leg.; MZUC-UCCC • Concepción; 22-I-1960; Trampas leg.M MZUC-UCCC • Concepción; 1-IV-1960; Trampas leg.; MZUC-UCCC • Concepción; 5-III-1959; Trampas leg.; MZUC-UCCC • Concepción; 21-III-1962; Trampas leg.; MZUC-UCCC • Concepción; 30-IX-2001; J. Artigas leg.; MZUC-UCCC • Concepción, Cerro Caracol; 30-II-2002; J. Artigas leg.; MZUC-UCCC • Concepción; 7-I-1961; Trampas leg.; MZUC-UCCC • 3 males; Concepción, Barrio Universitario; 4-V-1985; Carrasco leg.; MZUC-UCCC • Concepción; 29-XII-1958; Trampas leg.; MZUC-UCCC • Concepción; 16-III-1960; Trampas leg.; MZUC-UCCC. —**Arauco Prov.** • 1 male; Lanalhue; 22-I-2018; L. Parra leg.; "Mirg-001" [genitalia slide]; MZUC-UCCC • Lanalhue; 23-I-2018; L. Parra leg.; MZUC-UCCC. — **Biobío Prov.** • P.N. Laguna del Laja; 6-XII-2008; G. Moreno leg.; MZUC-UCCC. — **Malleco Prov.** • Nahuelbuta; Río Picoyquen; 22-XII-1960; Fetis leg.; MZUC-UCCC • Collipulli; 24-X-2014; E. Sepulveda leg.; "UCCC-MZUC-Lep 0308" [Museum ID]; MZUC-UCCC • Río Blanco; 19/25-II-1995; H. Thöny leg.; ZSM. — **Valdivia Prov.** 1 male; Valdivia; 30-IX-1987; Trampas leg.; MZUC-UCCC • 1 male; Valdivia; "5003" [Museum ID]; MNNC. — **Llanquihue Prov.** • Katalapi; 22-IV-2011; MZUC-UCCC. — **Coyhaique Prov.** • Coyhaique; I-1934; E. Ureta leg.; "Museo 5004" [Museum ID]; MNNC • 1 female; Lago Verde, R.N. Coyaique; 21-I-2007; MZUC-UCCC. — **Aysen Prov.** • 1 female; Río Maca, Cuenca Cuervo; -45.114703, -73.016065; 21-II-2008; "Mirg-020" [genitalia slide]; MZUC-UCCC. — **Capitán Prat Prov.** • Los Mellizos; 22-I-2008; Muñoz-Escobar leg.; MZUC-UCCC.

Additional records. CHILE. — **Itata Prov.** • La Palma; -36.567368, -72.689177; 9-IX-2021; observed by Claudio Maureira and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/100908464. — **Concepción Prov.** • Concepción; 4-XII-2021; -36.834994, -73.011375; observed by Flor Susana and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/102608301. • Concepción; 5-V-2023; -36.8354793349, -73.0287251249; observed by Luis Chavarriga and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/159871318. • Coliumo; 9-II-2023; -36.5526014, -72.9574049; observed by fpizarro and submitted to iNaturalist in:

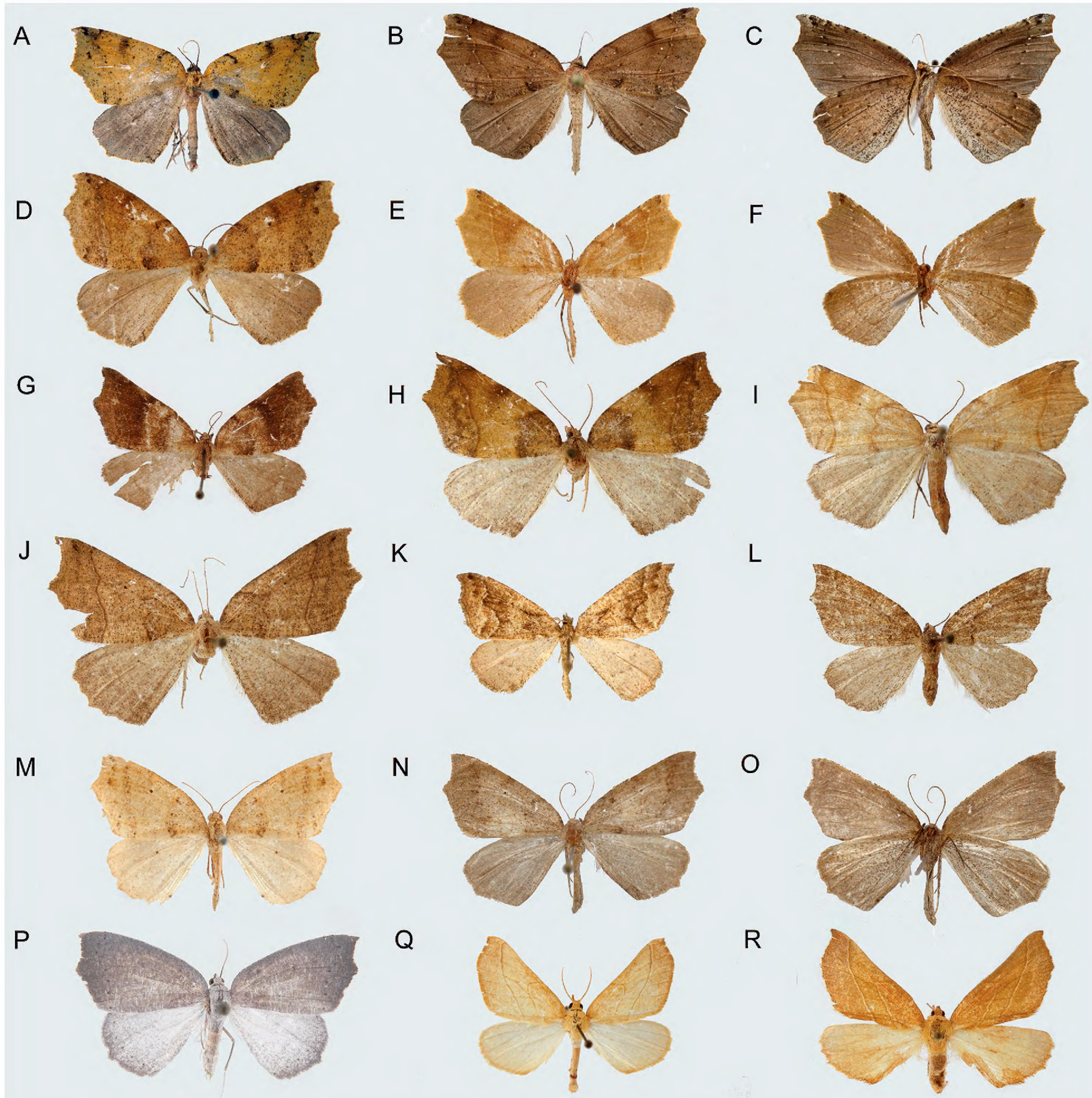

Figure 2. Habitus of *Digonis* adults **A** *Digonis aspersa* (male in dorsal view) **B** *Digonis aspersa* (male brown-morpho in dorsal view) **C** *Digonis aspersa* (male brown-morpho in ventral view) **D** *Digonis aspersa* (female in dorsal view) **E** *Digonis cervinaria*, stat. rev. (male olivaceous-morpho in dorsal view) **F** *Digonis cervinaria*, stat. rev. (male olivaceous-morpho in ventral view) **G** *Digonis cervinaria*, stat. rev. (male fuscous-morpho in dorsal view) **H** *Digonis cervinaria*, stat. rev. (female in dorsal view) **I** *Digonis cervinaria*, stat. rev. (female olivaceous-morpho in ventral view) **J** *Digonis cervinaria*, stat. rev. (female brown-morpho in ventral view) **K** *Digonis punctifera* (male in dorsal view; photo courtesy of A. Hausmann) **L** *Digonis punctifera* (female in dorsal view) **M** *Digonis gungnir* Ramos-González & Parra, sp. nov. (holotype in dorsal view) **N** *Digonis apocrypha* Ramos-González & Parra, sp. nov. (holotype in dorsal view) **O** *Digonis apocrypha* Ramos-González & Parra, sp. nov. (holotype in ventral view) **P** *Phasmadigonis alba*, comb. nov. (male in dorsal view) **Q** *Gugnelve butleri* Ramos-González & Parra, sp. nov. (holotype in dorsal view) **R** *Gugnelve butleri* Ramos-González & Parra, sp. nov. (allotype in dorsal view). Scale bar: 10 mm.

https://inaturalist.mma.gob.cl/observations/148464516. • Concepción; 20-XII-2023; -36.8263187829, -73.0265376168; observed by Antonio Maureira Navarrete and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/144894518 • Concepción; 15-XII-2022; -36.7784506232,

-73.0294558602; observed by Antonio Maureira Navarrete and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/144446815. • Concepción; 20-XII-2023; -36.8263187829, -73.0265376168; observed by Antonio Maureira Navarrete and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/144894518 — **Biobío Prov.** • Polcura; -37.285095, -71.718547; 20-III-2022; observed by Flor Susana and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/110011024. — **Osorno Prov.** • Osorno; -40.565175, -73.161816; 19-VI-2021; observed by Ricardo Huenuanca and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/83672367 • Osorno; -40.565183, -73.161729; 02-V-2021; observed by Ricardo Huenuanca and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/76765927 • Osorno; -40.565303, -73.162031; 09-I-2021; observed by Ricardo Huenuanca and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/67836032.

Diagnosis. This species can be easily distinguished from *D. punctifera* (Butler), *D. gungnir* Ramos-González & Parra, sp. nov., and *D. cervinaria* by its brownish forewings crossed by slightly sinuous bands and bicolored spots in the postmedial band at the level of veins R_3, R_4, R_5, M_1, M_2, M_3, CuA_1, CuA_2, and 1A+2A. Externally, it differs from *D. apocrypha* Ramos-González & Parra, sp. nov. because its bicolored spots appear on both sides of both pairs of wings with an equal proportion of white and black scales. It can be easily distinguished from its congeners by three other genitalia characters: a tongue-shaped furca that does not surpass the height of the transtilla, the presence of lateral spines in the distal half of the furca, and anterior apophyses directed towards the tergum.

Redescription. Male (Fig. 2A–C). Head: antennae slightly serrate; palpi long, one-third larger than eye diameter and slightly pointing upward; frons and vertex covered with mottled brownish gray scales. Thorax: patagia covered with elongated scales of same color as background; tegulae covered with piliform scales of same color as background; tibial spur formula 0-2-4. Forewings: subtriangular with acute apex and outer margin excavated between apex and M3, with a slight mucronate extension; fovea absent; background color variable, ranging from yellowish brown to dark brown with numerous small scattered blackish spots on the surface; antemedial band dark brown to blackish, slightly arched and marked by three bicolored spots (proximal half with whitish scales and distal half with blackish scales) at the level of radial, cubital, and anal veins respectively; medial band diffuse, blackish to smoky brown, more noticeable along the costal margin; postmedial band dark brown, slightly sinuous with the costal sector, strongly arched, with bicolored spots (proximal half with blackish scales and distal half with whitish scales) at the level of veins R_3, R_4, R_5, M_1, M_2, M_3, CuA_1, CuA_2, and 1A+2A, also visible on ventral side; subterminal band diffuse and marked only by dark spots in subapical region, at the level of medial veins and along the anal margin; discal spot visible, punctiform, and blackish. Hindwings: subrectangular with small mucronate apex at the level of M_3; background color grayish brown; postmedial band slightly smoky dark brown, marked by bicolored spots (proximal half with blackish scales and distal half with whitish scales) at the level of veins, also visible on ventral surface; discal spot visible only on ventral surface. Male genitalia (Fig. 3A, B). Uncus conical, apically club-shaped; gnathos U-shaped with expanded apex forming a pair of spiny lobes; valvae subrectangular, costa strongly sclerotized with distal lobe before apex, crescent-shaped, slightly convex, and

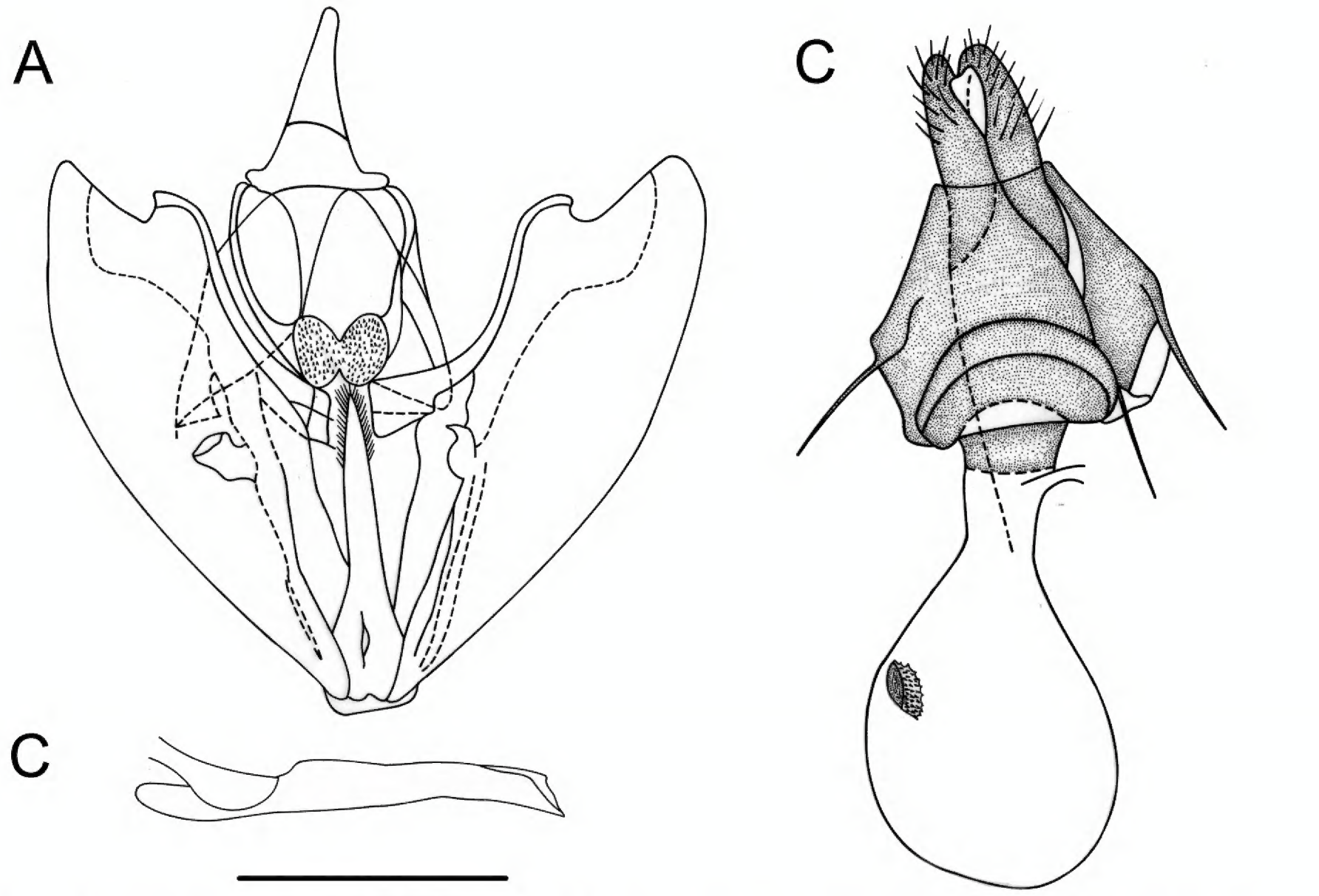

Figure 3. Genitalia of *Digonis aspersa* **A** male genitalia in ventral view **B** aedeagus in lateral view **C** female genitalia in ventral view. Scale bar: 1 mm.

cucullus extending beyond apex of costa; transtilla truncated; saccus subrectangular; juxta emarginated anteriorly, with a median dimple, and furca straight, short, does not surpass the height of the transtilla, tongue-shaped, spiny only laterally in the distal half; anellus sclerite weak, pentagonal in shape. Aedeagus tubular, straight; vesica without cornuti.

Female (Fig. 2D). Similar to male, but with simple antennae and well-defined Σ-shaped antemedial band. Female genitalia (Fig. 3C). Ductus bursae one-sixth the length of corpus bursae; lamella antevaginalis wide, strongly sclerotized; corpus bursae membranous, subpyriform with an annular, hollow, strongly denticulated signum anteriorly; posterior apophyses twice as long as anterior apophyses, anterior apophyses slightly bent towards tergite.

Distribution. This species is found between the Chilean provinces of San Antonio and Capitán Prat, with records in Neuquén, Argentina (Chalup 2020). It is distributed in parts of the biogeographic provinces of Santiago, Central Chilean subregion; Maule and Valdivian Forest, Subantarctic subregion, in the Andean region.

Flight period. Specimens were captured or observed in January, February, March, April, May, June, September, October, and December. There are no records for other months.

Remarks. Although the holotype stands out due to its yellowish tone, most examined specimens exhibit a brownish coloration. There is no evidence to suggest that this color variation reflects sexual dimorphism. The genitalia of these brown specimens are congruent with those of the holotype, indicating high variability in wing coloration.

***Digonis cervinaria* (Blanchard, 1852), stat. rev.**
Figs 2E–J, 4

Ennomos cervinaria Blanchard, 1852: 89.
Drepanogynis eversaria Guenée, 1858: 93 (unnecessary replacement name)
Digonis cervinaria (Blanchard, 1852); Scoble 1999: 229; Pitkin 2002: 248.
Digonis cuprea Butler, 1882: 362; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248. syn. nov.
Digonis cuprea fusca Butler, 1882: 362; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248. syn. nov.
Digonis cuprea olivacea Butler, 1882: 362; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248. syn. nov.

Material examined. *Syntypes* . CHILE • 1 female; Coquimbo; C. Gay leg.; "*Digonis cervinaria*" [labeled]; MNHN • 1 female; Valparaíso; T. Edmonds leg.; "*Digonis cuprea*" [labeled]; "Chili, 82-107"; "Type" [labeled]; NHMUK • 2 males; same data as for preceding but "*var. fusca*" [labeled]; "Type" [labeled] "Chili, 82-107" [labeled] and "*cuprea olivacea*" [labeled]; "Type" [labeled]; "Chili, 82-107" [labeled]; all NHMUK.

Other material examined. CHILE — **Valparaíso Prov.** • Viña del Mar; 8-VIII-1954; "Museo 5343" [Museum ID]; MNNC) • 1 female; Viña del Mar; 18-IV-1953; "Museo 5018" [Museum ID]; "Mirg-015" [genitalia slide]; MNNC; • 1 male; Viña del Mar; 15-X-1953; "Museo 5349" [Museum ID]; MNNC • 1 male; Viña del Mar; 15-VIII-1953; "Museo 5342" [Museum ID]; MNNC • 1 female; Viña del Mar; 12-IX-1953; "Museo 5350" [Museum ID]; MNNC • 1 male; Laguna Verde; 10-X-1936; E. Ureta leg.; "Museo 5014" [Museum ID]; MNNC. — **Marga Marga Prov.** • 1 male; Poza Azul, Marga Marga; 14-XII-1953; "Museo 5346" [Museum ID]; MNNC. — **Cordillera Prov.** • 1 male; La Obra; 26-III-1953; "Museo 5373" [Museum ID]; MNNC. — **Cachapoal Prov.** • 1 female; Termas de Cauquenes; 11-I-1953; E. Ureta leg.; "Museo 5006" [Museum ID]; "Mirg-013" [genitalia slide] • 1 male; Termas de Cauquenes; 11-I-1953; E. Ureta leg.; "Museo 5023" [Museum ID]; MNNC. — **Talca Prov.** 1 female; Panguilemo, La Calor; 1-II-2005; L. Parra leg.; "Mirg-009" [genitalia slide]; MZUC-UCCC. — **Diguillín Prov.** • 1 female; Las Trancas; 29-V-2011; G. Moreno leg.; "Mirg-016" [genitalia slide]; MZUC-UCCC. — **Concepción Prov.** • 1 female; Concepción; 6-I-1961; Trampas leg.; MZUC-UCCC. — **Malleco Prov.** • 1 female; Río Blanco, Curacautín; II-1995; H. Thöny leg.; ZSM. — **Cautín Prov.** • 1 female; Termas de Río Blanco; III-1951; MZUC-UCCC. — **Valdivia Prov.** • 1 female; Valdivia; I-1974; Cameron leg.; MZUC-UCCC. — **Osorno Prov.** • 1 female; Puerto Octay; 11-III-1956; Oehrens leg.; "Museo" [labeled]; MNNC. — **Palena Prov.** • Fjord Comau, Huinay Station, -42.381111, -72.414722, 20 m; 8-I-2008; A. Hausmann leg.; ZSM.

Additional records. CHILE — **Itata Prov.** • La Palma; -36.567339, -72.689122; 09-VI-2021; observed by Claudio Maureira and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/85725251. — **Concepción Prov.** • Concepción; -36.7928173278, -73.0525010616; 13-XII-2022; observed by Antonio Maureira Navarrete and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/144446817. — **Cautín Prov.** • Molco; -39.3393898652, -72.0921077239; 25-XII-2022; observed by Michael Weymann and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/145759642. • Molco; -39.3394188914, -72.0921402457; 25-XII-2022; observed by Michael Weymann and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/145759626. **Osorno**

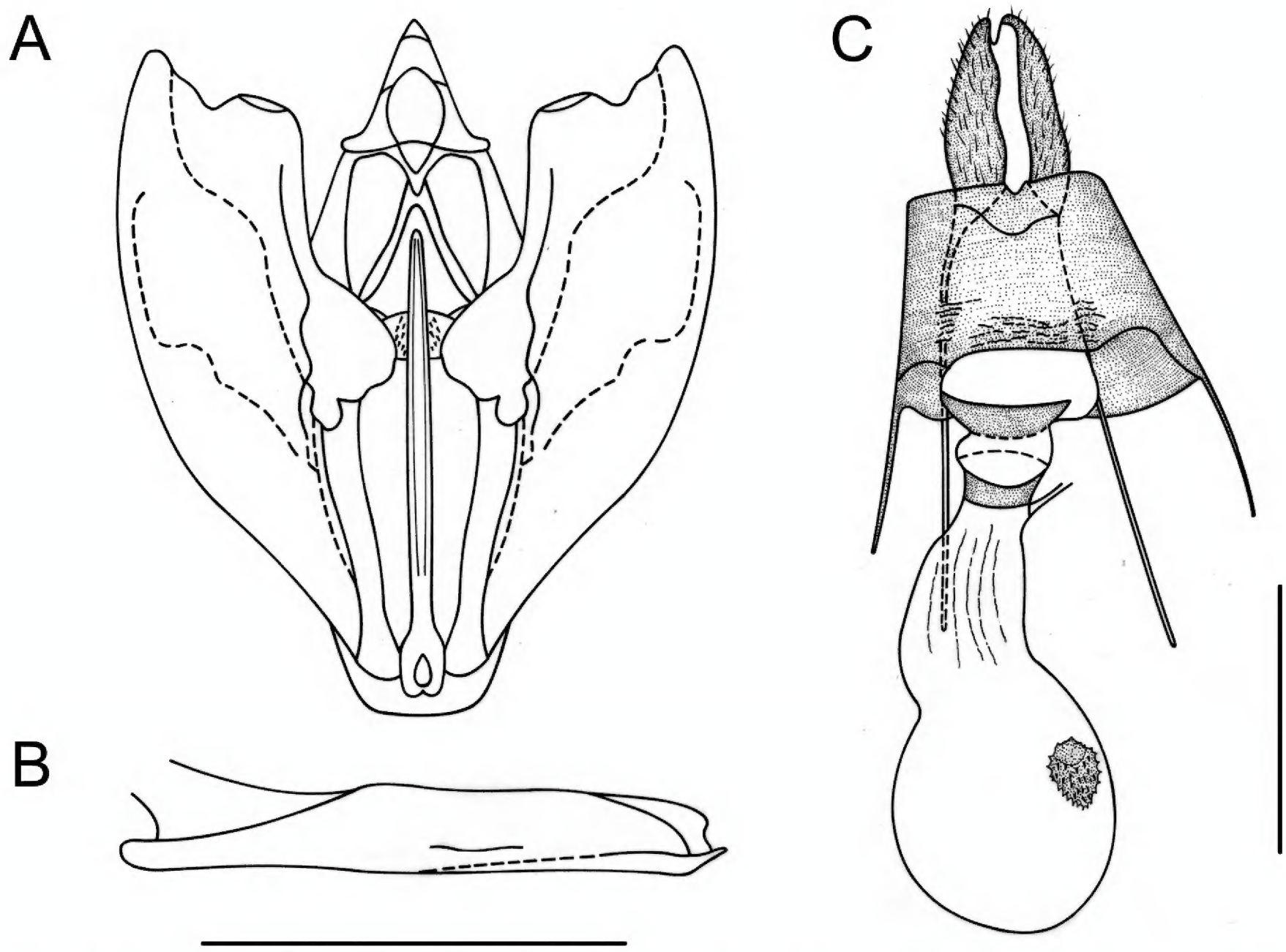

Figure 4. Genitalia of *Digonis cervinaria*, stat. rev. **A** male genitalia in ventral view **B** aedeagus in lateral view **C** female genitalia in ventral view. Scale bars: 1 mm.

Prov. • Osorno; -40.565282, -73.161883; 31-I-2021; observed by Ricardo Huenuanca and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/68898181 • Osorno; -40.565277, -73.162024; 3-I-2021; observed by Ricardo Huenuanca and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/67871022. — **Llanquihue Prov.** • Las Cascadas; -41.0799870456, -72.6350197924; 6-V-2023; observed by Mario Ramos and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/164957877. — **Chiloé Prov.** • Puntra; -42.119003, -73.81765; 27-II-2022; observed by Waldo Moyano and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/107842416.

Diagnosis. This species can be distinguished externally from other *Digonis* species by having elongated whitish spots at the level of veins R3, R4, R5, M1, M2, M3, CuA1, CuA2, and 1A+2A in postmedial region, also visible on ventral view. Male genitalia are characterized by the presence of a needle-shaped furca that surpasses the height of the transtilla, with only apical spines; costa strongly sclerotized with distal lobe, expanded before apex with truncated edge, and spatulate transtilla; aedeagus with a narrow and elongated caecum, one-third of the total length of the aedeagus.

Redescription. Male (Fig. 2E–G). Head: antennae slightly serrate; palpi short, subequal to eye diameter, porrect; frons and vertex covered with juxtaposed brownish scales. Thorax: patagia covered with elongated scales of same color as background; tegulae covered with piliform scales of same color as background; tibial spur formula 0-2-4. Forewings: subtriangular with acute apex and

outer margin excavated between apex and M_3, with slight mucronate extension; fovea absent; background color variable, ranging from olive-brown to dark brown; antemedial band dark brown to blackish, slightly sinuous; medial band diffuse, blackish to smoky brown, slightly oblique and in contact with postmedial band near anal margin; postmedial band dark brown, slightly sinuous with the costal sector, near apex, strongly arched, and with elongated whitish spots at the level of veins R_3, R_4, R_5, M_1, M_2, M_3, CuA_1, CuA_2, and 1A+2A, also visible on ventral view; subterminal band diffuse and marked only by dark spots in subapical region; discal spot visible, punctiform, and blackish. Hindwings: subrectangular with small mucronate apex at the level of M_3; background color grayish brown; postmedial band dark brown, slightly smoky, marked by elongated whitish spots at the level of veins, only visible on ventral surface; discal spot visible only on ventral surface. Male genitalia (Fig. 4A, B). Uncus conical, apically halberd-shaped; gnathos U-shaped with an expanded apex forming a pair of spiny lobes; valvae subrectangular, costa strongly sclerotized with a distal lobe before the apex, truncated, slightly convex, and cucullus extending beyond the apex of the costa; transtilla spatulate; saccus membranous; juxta emarginated anteriorly, with a median dimple, and furca straight, longitudinally striated, long, surpassing the height of the transtilla, needle-shaped, spiny only apically; anellus sclerite weakly defined. Aedeagus tubular, straight; caecum narrow and elongated, one-third of the total length of the aedeagus; vesica without cornuti.

Female (Fig. 2H–J). Similar to male, but with simple filiform antennae, Σ-shaped antemedial band, and zigzagging subterminal band. Female genitalia (Fig. 4C). Ductus bursae one-fourth the length of the corpus bursae; lamella antevaginalis, sclerotized; corpus bursae membranous, subpyriform with an annular, hollow, strongly denticulated signum anteriorly; posterior apophyses three times longer than the anterior apophyses.

Distribution. This species is found between the Elqui and Palena provinces. It is distributed in parts of the biogeographic provinces of Coquimbo and Santiago, Central Chilean subregion; Maule and Valdivian Forest, Subantarctic subregion, in the Andean region.

Flight period. Specimens were captured or observed in January, February, March, April, May, June, August, September, October, and December. There are no records for other months.

Digonis punctifera **Butler, 1882**

Figs 2K, L, 5

Digonis punctifera Butler, 1882: 363; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Pitkin 2002: 248.

Digonis punctifera acuminata Butler, 1882: 363; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Pitkin 2002: 248. syn. nov.

Digonis punctifera fumosa Butler, 1882: 363; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Pitkin 2002: 248. syn. nov.

Digonis punctifera maculosa Butler, 1882: 363; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Pitkin 2002: 248. syn. nov.

Digonis punctifera terranea Butler, 1882: 363; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Pitkin 2002: 248. syn. nov.

Material examined. *Syntypes*. CHILE • 1 male; Valparaíso; T. Edmonds Leg; "Type" [labeled]; "Chili, 82-107" [labeled]; NHMUK • 1 female; Valparaíso; T. Edmonds leg.; "*var. acuminata*" [labeled]; "Type" [labeled]; "Chili, 82-107" [labeled]; NHMUK • 1 male; Valparaíso; T. Edmonds leg.; "var. *fumosa*" [labeled]; "Type" [labeled]; "Chili, 82-107" [labeled]; NHMUK • 2 females; same data as for preceding but "*var. maculosa*" [labeled]; "Type" [labeled]; "Chili, 82-107" [labeled]; all NHMUK • 1 male; same data as for preceding but "*var. terranea*" [labeled]; "Type" [labeled]; "Chili, 82-107" [labeled]; NHMUK.

Other material examined. CHILE — **Limarí Prov.** • Ovalle, Quebrada Seca; 28/29-XI-1997; ZSM • 1 female; Ovalle, Los Molles; 16/19-X-1994; ZSM. — Petorca Prov. • 1 male and 1 female; Cachagua, Quebrada Aguas Claras; 5-III-1997; ZSM. — **Valparaíso Prov.** • 1 female; Viña del Mar; 4-IV-1953; "Mirg-011" [genitalia slide]; MNNC. • 3 males and 1 female; Valparaíso; 10-III-2006; H. Thoeny leg.; ZSM. — **Diguillín Prov.** • 1 male; Las Trancas; 8-II-2011; G. Moreno leg.; MZUC-UCCC.

Additional records. CHILE. — **Limarí Prov.** • P.N. Fray Jorge; -30.658155, -71.66439; 21-VII-2016; observed by Bastian Riveros and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/87956647.

Diagnosis. Externally, *D. punctifera* is characterized by the presence of a sinuous postmedial band that follows the shape of the wing's outer margin. The female genitalia are distinguished by a ductus bursae that is half the length of the corpus bursae and posterior apophyses five times longer than the anterior apophyses.

Redescription. Male (Fig. 2K). Head: antennae slightly serrate; palpi long, one-third longer than the eye diameter and slightly pointing upward; frons and vertex covered with mottled grayish brown scales. Thorax: patagia covered with elongated grayish brown and dark brown scales; tegulae covered with piliform scales of same color as patagia; tibial spur formula 0-2-4. Forewings: subtriangular with acute apex and outer margin excavated between apex and M_3, with slight mucronate extension; fovea absent; background color variable, ranging from yellowish brown to dark brown, with numerous small blackish spots scattered on surface; antemedial band faint, brownish dark, Σ-shaped; postmedial band dark brown, sinuous following the shape of the wing's outer margin, with a strip or whitish points toward the distal margin, not visible on ventral surface; subterminal band diffuse and marked only by dark spots in subapical region, at the level of medial veins and on anal margin; discal spot visible, punctiform, and blackish. Hindwings: subrectangular with small mucronate apex at the level of M_3; background color grayish brown; postmedial band dark brown, zigzagging, slightly smoky, and marked by blackish spots at the level of veins, also visible on ventral surface; discal spot visible, punctiform, and blackish. Male genitalia. Unknown.

Female (Fig. 2L). Similar to male but with simple filiform antennae and more defined antemedial band, also Σ-shaped. Female genitalia (Fig. 5). Ductus bursae half the length of the corpus bursae; lamella antevaginalis sclerotized; corpus bursae membranous, subpyriform with an annular, hollow, strongly denticulated signum anteriorly, located to the right of the corpus bursae; posterior apophyses five times longer than the anterior apophyses.

Distribution. This species is found between the Limarí and Diguillín provinces. It is distributed in parts of the biogeographic provinces of Coquimbo and Santiago, Central Chilean subregion; Maule, Subantarctic subregion, Andean region.

Flight period. Specimens were captured or observed in February, March, April, July, October, and November. There are no records for other months.

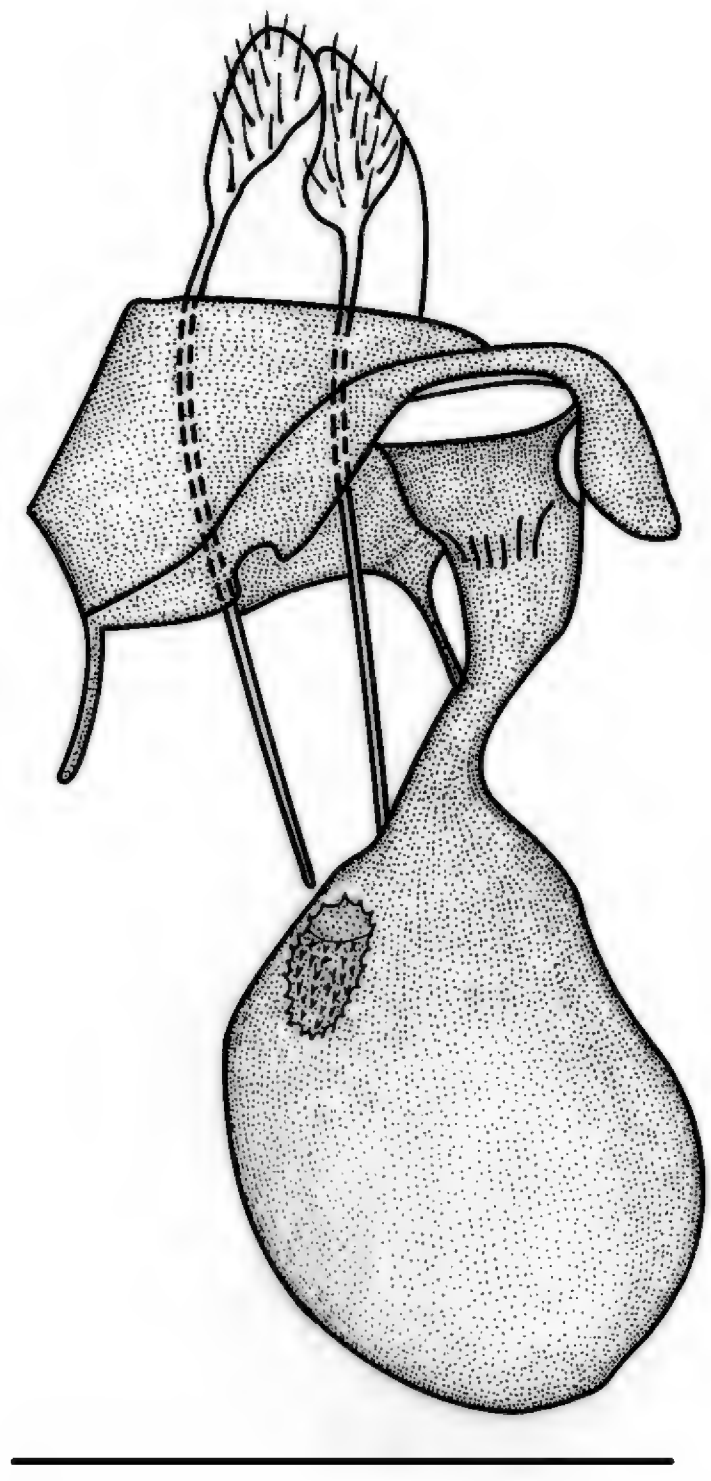

Figure 5. Female genitalia of *Digonis punctifera*. Scale bar: 1 mm.

***Digonis gungnir* Ramos-González & Parra, sp. nov.**
https://zoobank.org/2BE6459A-9B57-400B-91F1-844437B57E79
Figs 2M, 6

Type material. ***Holotype*.** Chile — 1 male; pinned; Coquimbo, Elqui, Huanta; 1936 (year without more data); E. Ureta leg.; "Holotype *Digonis gungnir*" [red handwritten label]; "5024" [Museum ID]; "Mirg-019" [genitalia slide]; MNNC. ***Paratypes*.** Chile — 1 male; pinned; Llanquihue Prov., Maullín; II-1943; S. Barros leg.; MZUC-UCCC • 1 male; pinned; Magallanes Prov., Punta Arenas, Tres Puentes; XII-1952; n.n. leg.; MZUC-UCCC.

Diagnosis. Externally, *D. gungnir* Ramos-González & Parra, sp. nov. is characterized by straw-colored wings and a straight postmedial band with pale points bordered in dark brown at veins R_4, R_5, M_1, M_2, and M_3 on the forewings. Male genitalia feature a presence of a poorly defined juxta, a slightly arched spear-shaped furca, and dense dorsal spines on the furca.

Description. Male (Fig. 2M). Head: antennae slightly serrate; palpi long, one-third longer than the eye diameter, porrect; frons and vertex covered with juxtaposed whitish scales. Thorax: patagia covered with elongated whitish scales; tegulae covered with very pale yellowish piliform scales; tibial spur formula

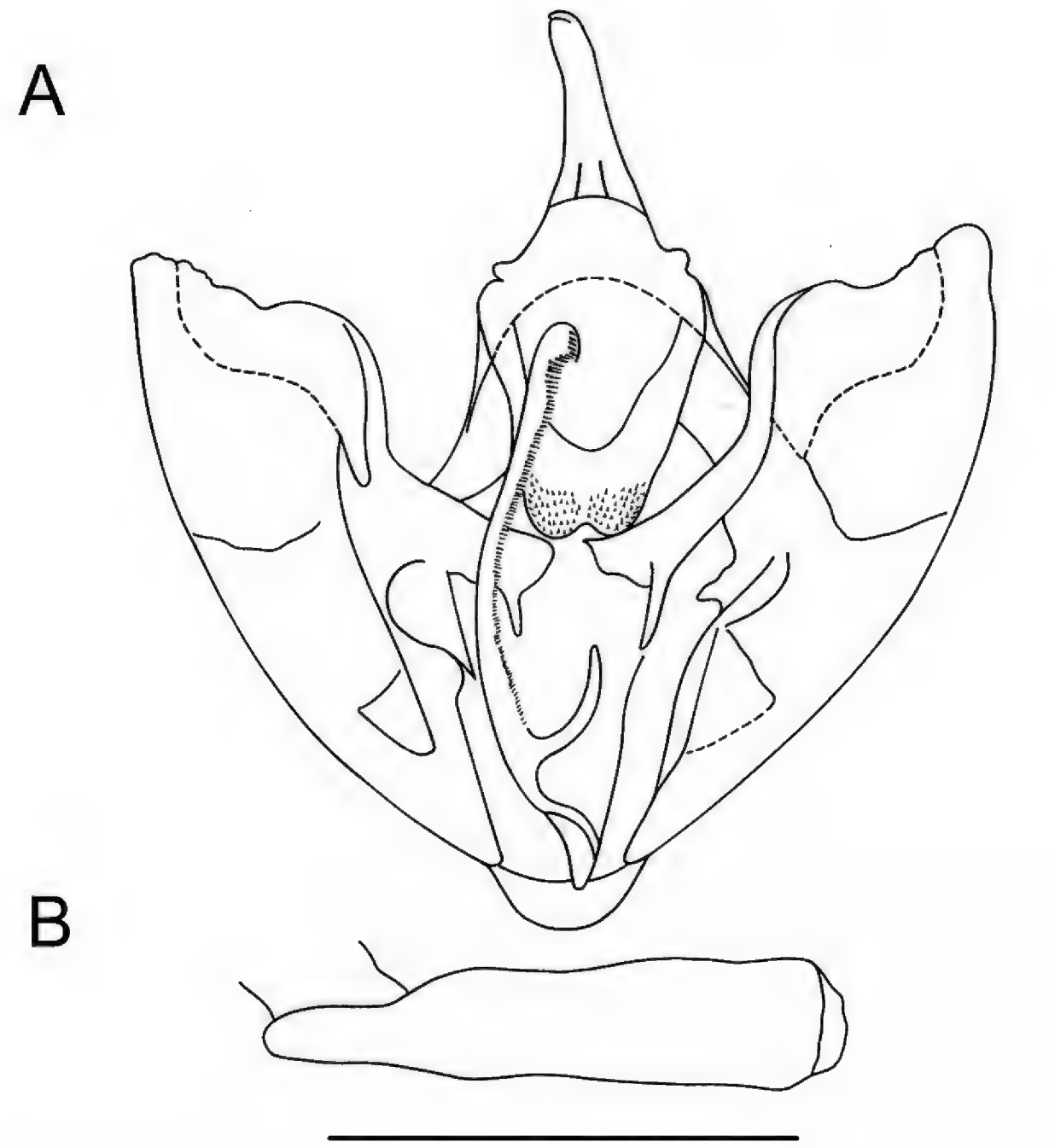

Figure 6. Genitalia of *Digonis gungnir* Ramos-González & Parra, sp. nov. (holotype) **A** male genitalia in ventral view **B** aedeagus in lateral view. Scale bar: 1 mm.

0-2-4. Forewings: subtriangular with acute apex and outer margin excavated between apex and M_3, with slight mucronate extension; fovea absent; background color straw-colored; antemedial band diffuse, marked by three light brown points at the level of radial, cubital, and anal veins respectively; medial band diffuse, light brown, slightly arched and more noticeable between the discal spot and the costa, zigzagging to the anal margin; postmedial band straight, diffuse, light brown, with five white points bordered in dark brown at the level of veins R_4, R_5, M_1, M_2, and M_3, visible only on ventral surface; subterminal band diffuse and demarcated only by dark spots in subapical region, at the level of medial veins and on anal margin; discal spot visible, punctiform, and blackish. Hindwings: subrectangular with small mucronate apex at the level of M_3; background color pale ashy; postmedial band light brown, slightly smoky, marked by elongated light brown spots at the level of veins, only visible on ventral surface; discal spot visible. Male genitalia (Fig. 6). Uncus conical, apex club-shaped; gnathos U-shaped with an expanded apex forming a pair of spinous lobes; valvae subrectangular, costa strongly sclerotized with a distal lobe before the apex, rounded, and cucullus extended beyond the apex of the costa; transtilla bifid; saccus subrounded; juxta poorly defined, pointed anteriorly, with a central depression, and with a furca curved to the left, long, surpassing the height of the transtilla, slightly arched spear-shaped, densely spiny dorsally, apex rounded; anellus sclerite weakly defined, only two subtriangular sclerites near the base of the furca are visible. Aedeagus tubular, straight; vesica without cornuti.

Female. Unknown.

Etymology. The species name is a noun in apposition, referring to Odin's spear (the chief god in Norse mythology), due to its longer and more armed furca within the genus. Gungnir is treated here as a neuter noun.

Distribution. This species is found between the provinces of Elqui and Magallanes. It is distributed in parts of the biogeographic provinces of Coquimbo and Santiago, Central Chilean subregion; Maule, Valdivian Forest, and Magellanic Forest, Subantarctic subregion, Andean region.

Flight period. Specimens were captured in December and February. There are no records for other months.

***Digonis apocrypha* Ramos-González & Parra, sp. nov.**
https://zoobank.org/458C9CE8-3466-4EEE-99A0-35F4E244557C
Figs 2N, O, 7

Type material. ***Holotype*.** CHILE: 1 male; pinned; Ñuble, Las Trancas; 31-III-2011; G. Moreno leg.; "Holotype *Digonis apocrypha*" [red handwritten label], "UCCC_MZUC_Lep_0300" [Museum ID], "Mirg-021" [genitalia slide] (MZUC-UCCC). ***Paratypes*.** CHILE — **Diguillín Prov.** • 1 male; pinned; Ñuble, Recinto; 06-II-2011; G. Moreno leg.; MZUC-UCCC • 1 male; pinned; same data as holotype but "UCCC_MZUC_Lep_0304" [Museum ID] (MZUC-UCCC) • 2 males; pinned; same data as holotype but 12-IV-2013; "UCCC_MZUC_Lep_1729" and "UCCC_MZUC_Lep_1730" [Museum ID]; MZUC-UCCC • 2 males; pinned; same data as holotype but 20-III-2011; "UCCC_MZUC_Lep_0330" and "UCCC_MZUC_Lep_0320" [Museum ID]; MZUC-UCCC • 1 male; pinned; same data as holotype but 16-IV-2010; "UCCC_MZUC_Lep_0303" [Museum ID]; MZUC-UCCC • 2 males; pinned; same data as holotype but 7-IV-2010; MZUC-UCCC • 1 male; pinned; same data as holotype but "UCCC_MZUC_Lep_0301" [Museum ID]; MZUC-UCCC • 1 male; pinned; same data as holotype but 29-V-2011; "UCCC_MZUC_Lep_0302" [Museum ID]; MZUC-UCCC • 1 male; pinned; same data as holotype but 18-III-2012; "UCCC_MZUC_Lep_1160" [Museum ID]; MZUC-UCCC. — **Valdivia Prov.** • 1 male; pinned; 09-IV-2010; Huilo-Huilo, Mocho-Choshuenco volcano; -39.911943; -71.969167; L. Roa and D. Vergara leg.; MZUC-UCCC. — **Capitán Prat Prov.** • 1 male; pinned; Cochrane; 11-IV-2008; Parra and Alvarado leg.; "sampled in scrub of Notro-Ñirre" [labeled] (*Embothrium coccineum* (Proteaceae) - *Nothofagus antarctica* (Nothofagaceae)); MZUC-UCCC.

Diagnosis. This species is distinguished from the other species in the genus by the presence of elongated blackish marks with small whitish point at the level of veins in the postmedial band of the forewings, which are not visible in ventral view. In the male genitalia, it differs from *D. aspersa* by the elongated and striated furca, more similar to that of *D. cervinaria*. It also differs from *D. cervinaria* because it has spines around the distal half of the furca. This species stands out for the presence of a U-shaped gnathos with an expanded apex like a denticulate plate, transtilla with a digitiform process at the apex, and aedeagus with a fine and elongated caecum, half the total length of the aedeagus.

Description. Male (Fig. 2N, O). Head: antennae slightly serrate; palpi long, one-third longer than the eye diameter, porrect; frons and vertex covered with grayish brown scales. Thorax: patagia covered with elongated scales of same color as background; tegulae covered with piliform scales of same color as background;

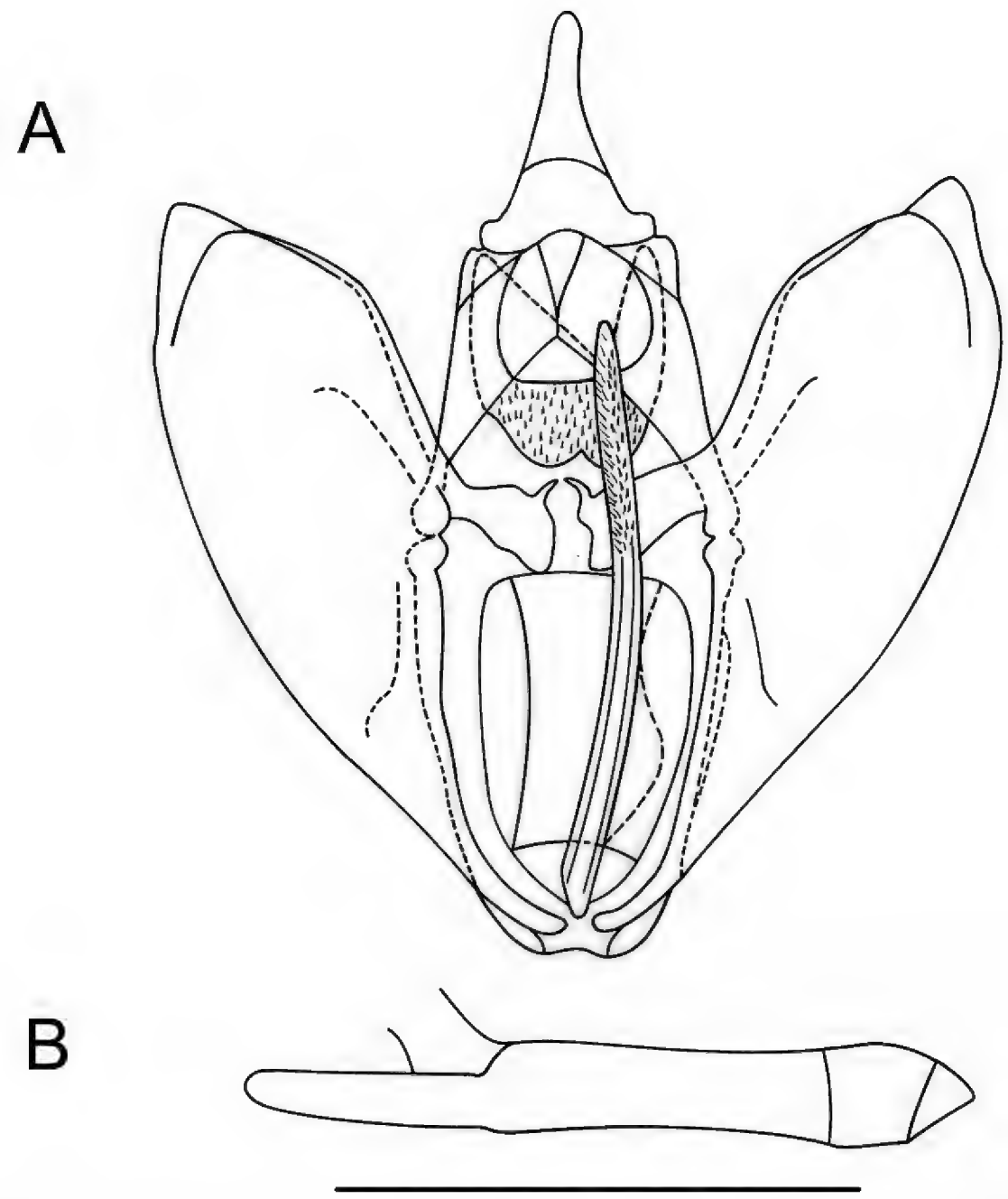

Figure 7. Genitalia of *Digonis apocrypha* Ramos-González & Parra, sp. nov. (holotype) **A** male genitalia in ventral view **B** aedeagus in lateral view. Scale bar: 1 mm.

tibial spur formula 0-2-4. Forewings: subtriangular with acute apex and outer margin excavated between apex and M_3, with slight mucronate extension; fovea absent; pale ashy background with a large number of small blackish spots scattered over the surface; antemedial band diffuse, slightly zigzagging, marked by three dark brown points at the level of radial, cubital, and anal veins respectively; medial band light brown, diffuse; postmedial band, diffuse, light brown, with bicolored spots (elongated blackish mark with the center marked by a whitish point) at the level of veins R_4, R_5, M_1, M_2, M_3, CuA_1, CuA_2, and 1A+2A, not visible on ventral surface. Hindwings: subrectangular with small mucronate apex at the level of M_3; pale ashy background, without visible bands or spots; discal spot visible. Male genitalia (Fig. 7). Uncus conical, apex club-shaped; gnathos U-shaped with an expanded apex like a denticulate plate; valvae subrectangular, costa strongly sclerotized with a distal lobe before the apex, rounded, and cucullus extended beyond the apex of the costa; transtilla bifid; saccus membranous, weakly defined; juxta poorly defined, with a central depression and furca, long, surpassing the height of the gnathos, club-shaped with two longitudinal stripes, densely spiny towards the distal half; anellus sclerite weakly defined. Aedeagus tubular, straight; fine, elongated caecum, half the total length of the aedeagus; vesica without cornuti.

Female. Unknown.

Etymology. The species name is an adjective from Greek *aprocryphos* ("not genuine"), referring to the deceptive maculation pattern, superficially resembling *Digonis aspersa* Butler.

Distribution. This species is found between the provinces of Diguillín and Capitán Prat. It is distributed in parts of the biogeographic provinces of Maule, Valdivian Forest, Magellanic Forest, Subantarctic subregion, in the Andean region.

Flight period. Specimens were captured in February, March, April, and May. There are no records for other months.

Phasmadigonis gen. nov.

https://zoobank.org/F0922815-E334-4247-9CE0-9F98FD0DABE0

Type species. *Digonis alba* Butler, 1882.

Diagnosis. *Phasmadigonis* bears resemblance to *Digonodes* Warren, 1895, *Digonis* Butler, 1882, and *Gonogala* Butler, 1882, particularly due to the mucronate shape of the wings. However, *Phasmadigonis* can be distinguished by the presence of vein Sc connected by a vein to the single accessory cell in the forewings and by having vein Sc+R1 connected to radial trunk by a weak vein in the hindwings. *Phasmadigonis* is distinguished by the following genitalia characters: gnathos V-shaped with the absence of lobes or spines, spatulate transtilla, broad shovel-shaped juxta, furca armed with small sagittal spines and a dimple in the sclerite at its base, aedeagus with a digitiform apex, and vesica armed with a large spine.

Description. Antennae serrated in males and filiform in females. Thorax and abdomen with grayish scales. Forewings gray-lilac reticulated with white, lacking bands, subterminal region delimited only by a series of blackish spots at the level of R2, R3, R4, M1, M2, M3, CuA1, CuA2, and 1A+2A; costa margin in apical zone is slightly arched; outer margin is concave between apex and M3. Wing venation (Fig. 8): one accessory cell; Sc connected with accessory cell through a short vein, R1 and R2 arise from accessory cell, R3 and R4 are pedunculate, R5 terminates at termen; M2 equidistant from M1 and M3, M3 slightly arched and ending in small mucronate apex; CuA1 arises 1/10 before end of cell, CuA2 arises near middle of cell. Hindwings paler than forewings, with subterminal region delimited by series of dark spots at the level of veins. Sc+R1 connected to radial trunk by a weak transverse vein, Rs arises 1/6 before end of cell, M2 is absent. Male genitalia with rod-like uncus; gnathos V-shaped; valvae suboval; transtilla spatulate; furca spiny; vesica with prominent spine.

Etymology. The generic name is formed by combining the Greek *phasma* (meaning phantom or apparition), with *Digonis* in reference to the false resemblance to moths of the genus *Digonis* Butler and the wing coloration; its gender is neuter.

Distribution. Similar to its sole species, *P. alba* (Butler)

Phasmadigonis alba (Butler, 1882), comb. nov.

Figs 2P, 9

Digonis alba Butler, 1882: 361; Bartlett-Calvert 1886: 333; Angulo and Casanueva 1981: 12; Scoble 1999: 229; Pitkin 2002: 248.

Material examined. *Syntype*. CHILE • 1 female; pinned; Mountains of the hacienda of Cauquenes; T. Edmonds leg.; "Chili, 82-107" [labeled]; "Type" [labeled]; NHMUK.

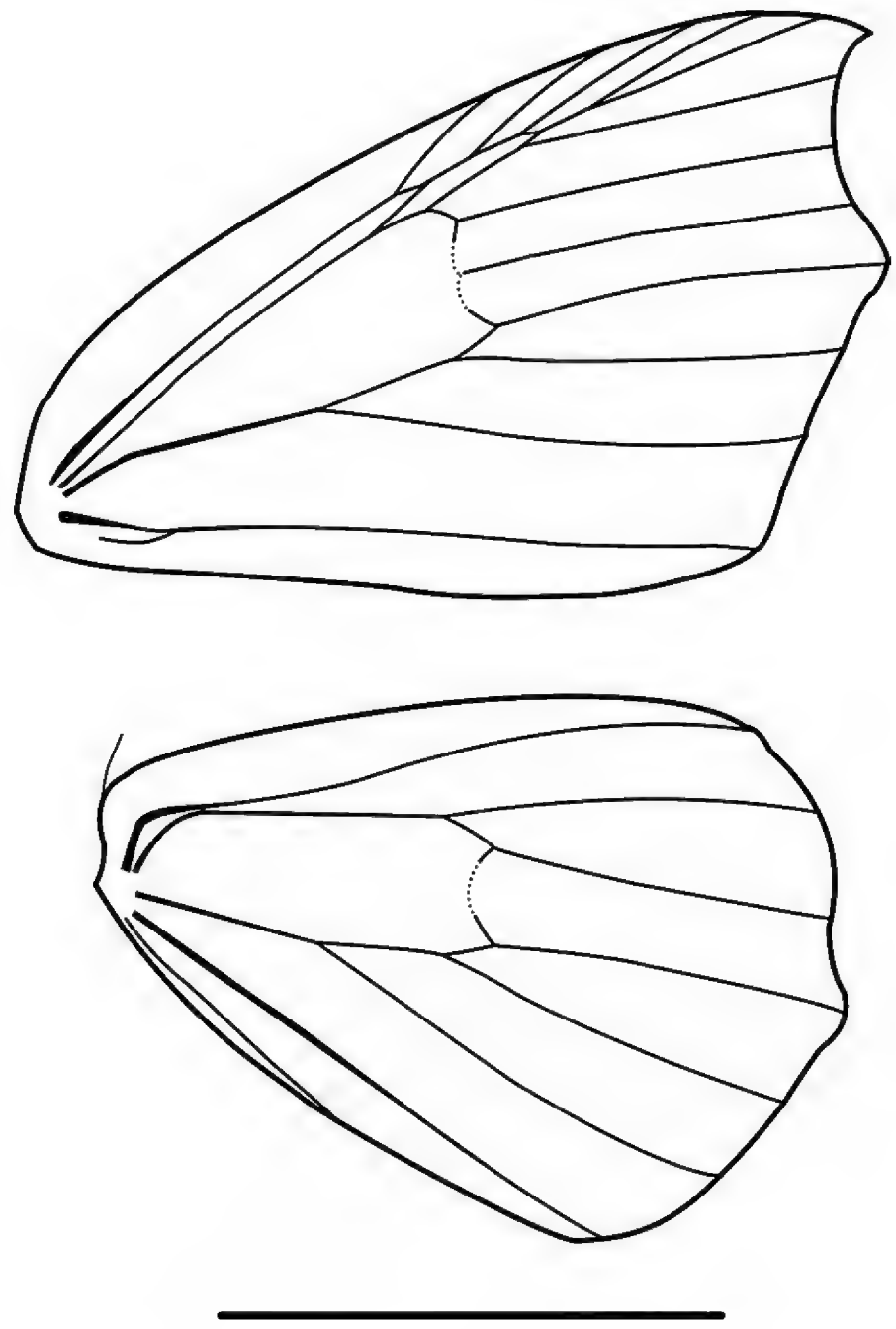

Figure 8. Wing venation of *Phasmadigonis* Ramos-González & Parra, gen. nov. Scale bar: 10 mm.

Other material examined. CHILE — • 1 male; Chile; "Museo 5022" [Museum ID]; MNNC. — **Diguillín Prov.** • 1 male; Ñuble, Las Trancas; 18-III-2012; G. Moreno leg.; "UCCC-MUZC-Lep1173" [Museum ID]; "MMA1173" [genitalia slide]; MZUC-UCCC. — **Araucanía Region** • 1 male; Araucanía, II-1888, coll. n.n, "Museo 5029" [Museum ID]; MNNC; • 2 males; same data as for precedings but "Museo 5027" [Museum ID] and "Museo 5028" [Museum ID]; all MNNC. — **Chiloé Prov.** • 1 male; Mocopulli, Ruta 5 Sur km 1170, -42.368000, -73.728833, 182 m; 3-II-2017, leg. M. Ramos-G, M. Ramos-SM & C. Rose.

ARGENTINA — • 1 male; Río Negro Prov., Bariloche; 29-I-1991; H. Ibarra-Vidal leg.; "HIV-0034" [Museum ID]; MHNC.

Additional records. CHILE. — **Talca Prov.** • Cipreses hydroelectric plant; -35.7867249, -70.8078157; 16-XII-2023; observed by César Picar and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/196336300. • Cipreses hydroelectric plant; -35.7865833685, -70.8078496903; 21-I-2024; observed by César Picar and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/197310545.

Diagnosis. As for the genus.

Redescription. Male (Fig. 2P). Head: antennae slightly serrated; short palpi, subequal to eye diameter, porrect; frons and vertex covered with juxtaposed brownish scales. Thorax: patagia covered with elongated scales of same color as background; tegulae covered with piliform scales of same color as background; tibial spur formula 0-2-4. Forewings: subtriangular with acute apex and outer

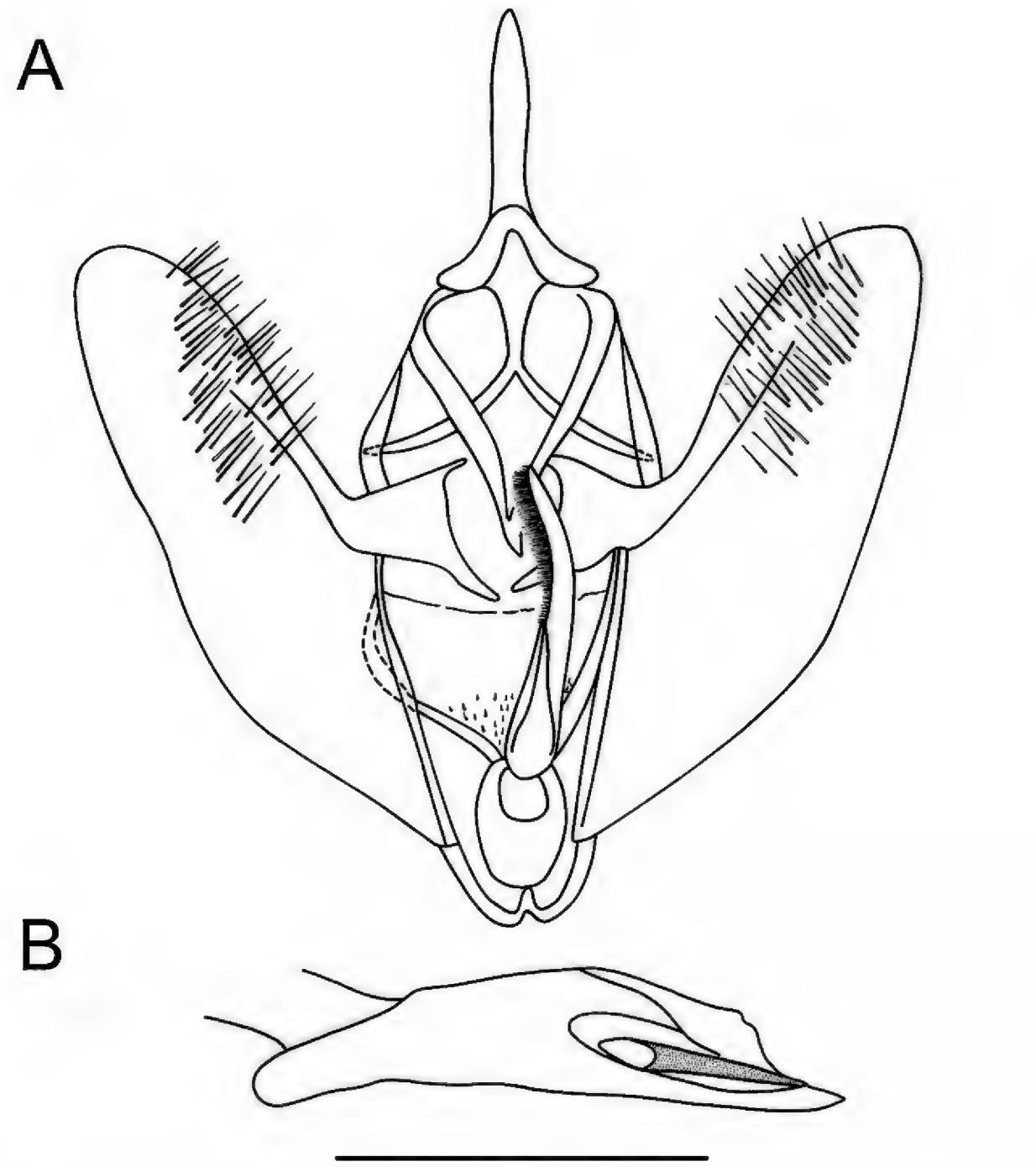

Figure 9. Genitalia of *Phasmadigonis alba*, comb. nov. **A** male genitalia in ventral view **B** aedeagus in lateral view. Scale bar: 1 mm.

margin excavated between apex and M_3, with a slight mucronated extension; fovea absent; ground color gray-lilac reticulated with white; bands absent, only observable on wing surface are blackish points in subterminal area at the level of veins R_2, R_3, R_4, M_1, M_2, M_3, CuA_1, CuA_2, and 1A+2A, also visible on ventral side; discal spot visible, punctiform, and blackish. Hindwings: subrectangular with small mucronated apex at the level of M_3; ground color ash-white, termen grayish; bands absent, only observable on wing surface is a row of blackish dots in subterminal area at the level of veins $Sc+R_1$, Rs, M_1, M_3, CuA_1, CuA_2, and 1A; discal spot visible. Male genitalia (Fig. 9). Uncus straight, apex rod-like; gnathos V-shaped; valvae suboval, valvula and cucullus slightly setose, costa sclerotized; transtilla spatulate with sharp, projected vertices; saccus obcordate; juxta shovel-shaped, dorsally flattened and extended, with finger-shaped furca curved to the left, short, not surpassing the height of the transtilla,, densely spiny sagittally; anellus sclerite weakly defined. Aedeagus tubular, straight, apex digitiform; vesica armed with a large spine.

Female. Unknown.

Distribution. This species is found between the provinces of Cachapoal and Chiloé (Chile) and Río Negro (Argentina). It is distributed in parts of the biogeographic provinces of Santiago, Central Chile subregion; Maule and Valdivian Forest, Subantarctic subregion, in the Andean region.

Flight period. Specimens were captured in December, January, February, and March. There are no records for other months.

Tribe Nacophorini Forbes, 1948

Gugnelve gen. nov.

https://zoobank.org/5D5F1234-1907-4D23-A970-C051EF3D8DEA

Type species. *Gugnelve butleri* Ramos-González & Parra, sp. nov.

Diagnosis. Externally, *Gugnelve* resembles *Euangerona* Butler and *Dectochilus* Warren. All three genera have an oblique curved band in the central area of the forewings. However, *Euangerona* and *Dectochilus* have a wavy termen, unlike *Gugnelve*, which has a smooth termen and a slightly falcate apex. The wing shape and antennae are similar to those of *Laninia* Orfila & Schajovskoy and *Macrolyrcea* Butler, but they differ significantly in various genital structures, such as the gnathos with a posteriorly directed apex and distally lobulated costa in *Laninia* and the spatulate uncus and wide oval valvae in *Macrolyrcea*. The V-shaped gnathos with a longitudinal row of spicules is reminiscent of *Euangerona* and *Dectochilus*, but in both of those genera, the anellus process is directed anteriorly, while in *Gugnelve*, it is oriented lateroposteriorly. The uncus and juxta resemble those of *Malleco* Rindge, but in *Gugnelve*, the uncus is glabrous, and the anellus process is trifid, while the gnathos of *Malleco* has multiple spicules on the lateral arms and apex. Finally, the new genus differs considerably in external characteristics and genitalia from other Andean Nacophorini like *Catophoenissa* Warren, 1894, *Catocalopsis* Rindge, 1971, *Talca* Rindge, 1971, and *Wichanraran* Parra, 2018. *Gugnelve* is distinguished by the following combination of genital characters: V-shaped gnathos with a row of 11 spicules at the apex, forked transtilla, halberd-shaped juxta laterally extended into a pair of tri-spined anellus processes, strongly sclerotized and glabrous, vesica armed with a series of cornuti, signum with a long blade-like ridge on a sclerotized patch.

Description. Antennae thickened and slightly serrated in males, filiform in females. Robust thorax with yellowish brown piliform scales. Abdomen with belt of white scales on A1 and A2. Forewings yellowish brown, subtriangular, slightly falcate, with sinuous and inclined antemedial and postmedial bands. Wing venation (Fig. 10). Two accessory cells, second twice as long as first; Sc in contact with first accessory cell, R1 originates from middle of second accessory cell, R2 and R3+4 connate, R3 and R4 pedunculate, R5 terminates at termen; M2 equidistant from M1 and M3, M3 slightly arched; CuA1 originates 1/8 before end of cell, CuA2 originates near middle of cell. Hindwings paler than forewings, with yellowish brown piliform scales on the termen. Sc+R1 in contact with radial trunk up to middle of cell, Rs originates 1/12 before end of cell, M2 absent. Male genitalia with V-shaped gnathos, expanded apex with 11 small variably-sized denticles towards the center; valvae sub-rhomboidal; juxta sub-halberd-shaped, laterally extended into a pair of tri-spined, strongly sclerotized processes. Female genitalia with signum with long blade-like ridge on sclerotized patch.

Etymology. The generic name is derived from the Mapudungun language (spoken by the Mapuche, the largest indigenous group in Chile), wün̲yelfe, meaning bright star or Venus, in reference to its yellowish coloration; its gender is neuter.

Distribution. As for its only species, *G. butleri* Ramos-González & Parra, sp. nov.

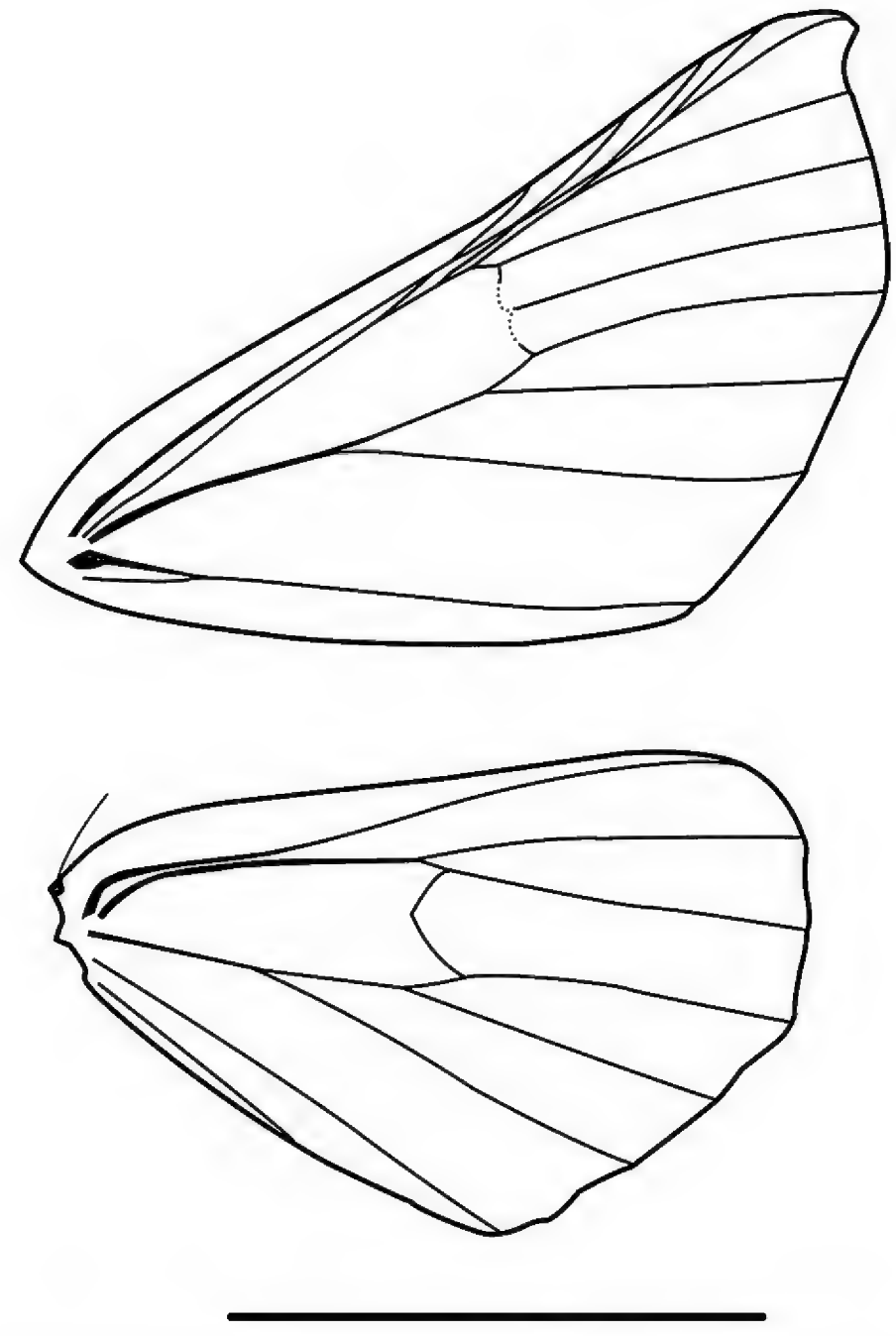

Figure 10. Wing venation of *Gugnelve* Ramos-González & Parra, gen. nov. Scale bar: 10 mm.

***Gugnelve butleri* Ramos-González & Parra, sp. nov.**
https://zoobank.org/80882365-C942-46DB-AAD3-FC68E5CE32D8
Figs 2Q, R, 11

Erosina cervinaria (Blanchard, 1852); Butler 1882: 347 pl. 16, fig. 4; Bartlett-Calvert 1886: 331; Angulo and Casanueva 1981: 12 [misidentification of *Ennomos cervinaria* Blanchard].

Type material. ***Holotype*.** Chile • 1 male; Cordillera Prov., Santiago, Guayacan; XII-1950; "Holotype *Gugnelve butleri*" [red handwritten label], "Mirg-017" [genitalia slide] (MZUC-UCCC). ***Allotype*.** Chile • 1 female, Cordillera Prov., Santiago, Guayacan; I-1951; "Allotype *Gugnelve butleri*" [red handwritten label], "Mirg-018" [genitalia slide] (MZUC-UCCC). ***Paratypes*.** Chile — **Limarí Prov.** • 2 males, Ovalle, Quebrada Seca; 28/29-XI-1997; ZSM. — **Cordillera Prov.** • 4 females and 1 male, same data as Holotype; • 1 female and 1 male, same data as allotype.

Other material examined. Chile — **Cachapoal Prov.** • 1 female; Termas de Cauquenes; 11-I-1953; "Museo 4516" [Museum ID]; MNNC.

Additional records. Chile. — **Cachapoal Prov.** • Mountains of the hacienda of Cauquenes; January; T. Edmonds leg.; NHMUK (Butler, 1882) — **Talca Prov.** • Parque Natural Tricahue; -35.70869903, -71.08727243; 5-I-2020; observed by Vicente Pantoja and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/37300513. • Cipreses hydroelectric plant; -35.8099272997, -70.8359745; 17-XII-2022; observed by César Picar and submitted to iNaturalist

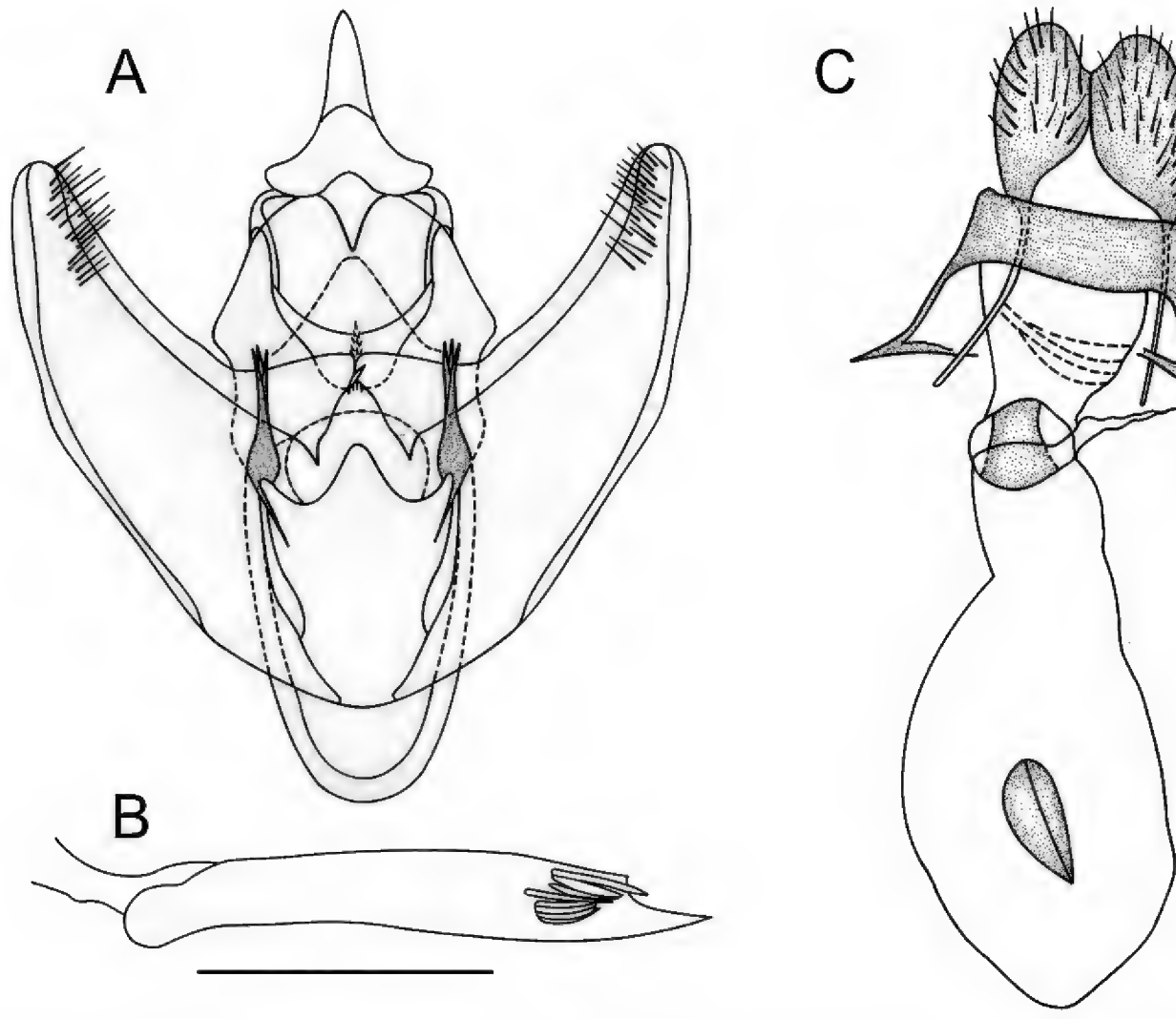

Figure 11. Genitalia of *Gugnelve butleri* Ramos-González & Parra, sp. nov. (holotype and allotype) **A** male genitalia in ventral view **B** aedeagus in lateral view **C** female genitalia in ventral view. Scale bars: 1 mm.

in: https://iNaturalist.mma.gob.cl/observations/144651054. • Cipreses hydroelectric plant; -35.8096577, -70.8353316; 10-I-2024; observed by César Picar and submitted to iNaturalist in: https://inaturalist.mma.gob.cl/observations/196337433.

Diagnosis. As for the genus.

Description. Male (Fig. 2Q). Head: antennae slightly serrated; palpi short, subequal to the eye diameter, porrect; frons and vertex covered with juxtaposed brownish scales. Thorax: Patagia covered with elongated scales of same color as background; tegulae covered with piliform scales of same color as background; tibial spur formula 0-2-4. Forewings: slightly falcate, subtriangular; fovea absent; background color yellowish brown; antemedial band dark yellowish brown, externally bordered by pale brown, oblique, extending toward the medial area, near the end of the discal cell where it curves toward the antemedial sector to the costa, forming an acute arc; postmedial band dark yellowish brown, externally bordered by pale brown, slightly sinuous, oblique, and slightly curved, extending to the subapical sector; discal spot not visible. Hindwings: suboval; background color pale brown without bands; discal spot not visible. Male genitalia (Fig. 11A, B). Uncus conical; socii slightly setose; gnathos V-shaped with sinuous arms, expanded apex with 11 small denticles of varying sizes toward the center; valvae sub-rhomboidal, costa and anterior margin sclerotized; transtilla fork-shaped; saccus suboval; juxta sub-halberd-shaped, laterally extended into a pair of tri-spined strongly sclerotized processes; anellus sclerite weakly defined. Tubular aedeagus, straight; vesica armed with cornuti, formed by 11 grouped spines of different sizes.

Female (Fig. 2R). Similar to male but with simple filiform antennae, dark yellowish brown falcate forewings, and slightly crenulated pale brownish gray subrectangular hindwings. Female genitalia (Fig. 11C). Ductus bursae half the

length of the corpus bursae; antrum funnel-like; corpus bursae membranous, subpyriform, signum with a long blade-like ridge on a sclerotized patch; posterior apophyses three times longer than anterior apophyses.

Etymology. The specific name is dedicated to Arthur Gardiner Butler, an ornithologist, arachnologist, and entomologist of the 19th century, for his contribution to the study of Lepidoptera in Chile.

Distribution. This species is found between the provinces of Limarí and Talca. It is distributed in parts of the biogeographic provinces of Coquimbo and Santiago, Central Chilean subregion; Maule, Subantarctic subregion, in the Andean region.

Flight period. Specimens were captured in November, December, and January. There are no records for other months.

Discussion

The genus *Digonis*, described by Butler in 1882, initially included *D. aspersa*, *D. cuprea*, *D. punctifera*, and *D. alba*. Additionally, Butler (1882) described various varieties for *cuprea* and *punctifera*, differentiating them based on the coloration of the forewings. However, the analysis of the genital structures of *D. punctifera* indicates that these differences in coloration are not sufficient to separate them into distinct species or subspecies within the genus, which is why they are synonymized.

The inclusion of the species *D. gungnir* Ramos-González & Parra, sp. nov. and *D. apocrypha* Ramos-González & Parra, sp. nov. in the genus *Digonis* is justified by the congruence in their external characteristics and genitalia. The distinction from their sister species is primarily focused on male genitalia characteristics. Therefore, the genus *Digonis* is composed of the following five species: *D. aspersa*, *D. cervinaria*, *D. punctifera*, *D. gungnir* Ramos-González & Parra, sp. nov., and *D. apocrypha* Ramos-González & Parra, sp. nov. Its validity as a taxon within the tribe Ennomini is supported by the presence of a membranous and weakly developed saccus, valvae with well-sclerotized outstanding costa, and well-developed furca (Beljaev 2008).

Based on the analysis of genital structures and wing venation, a strong incongruence is recognized between the species *D. alba* Butler and the rest of the species in *Digonis*. This aligns with what Pitkin (2002) indicated, suggesting that *D. alba* should be excluded from the genus due to certain incongruences with genital characters. The main differences between both genera lie in the shape of the valvae, furca, and wing venation configuration, a combination of characters not present in any other Ennomini genus in the Andean region (e.g., *Syncirsodes* Butler, *Gonogala* Butler, *Microclysia* Butler, *Perusia* Herrich-Schäffer, *Eusarca* Hübner), which supports the proposal of *Phasmadigonis* as a new genus. Additionally, we report the first record of this taxon for Argentina, specifically for the province of Río Negro.

The different species of the genus *Digonis* have distributions that cover most of the vegetation formations (sensu Luebert and Pliscoff 2018) in central-southern Chile. However, the highest species richness appears to be associated with the high-Andean deciduous forest of the Cordillera de Chillán (sensu Gajardo 1994). The lack of records in other areas may be due to a lack of comprehensive sampling, particularly in the central-northern zone of Chile

(north of Santiago). Future studies should address the rearing of different species to describe their host plants and immature stages, currently unknown.

Blanchard (1852) described the species *Ennomos cervinaria* based on a specimen from Coquimbo, providing a brief and imprecise description, and without including figures. Later, Guenée (1858) redescribed it in more detail, characterizing it by the elongated whitish marks on the wing veins, visible in both dorsal and ventral views. Furthermore, Guenée proposed a new name for this species, arguing that "*cervinaria*" was already used for a species of *Eubolia* Duponchel, 1829 (current *Larentia clavaria* Duponchel, 1845). Subsequently, Butler (1882) incorporated this species into the genus *Erosina* Guenée, 1858, arguing that, if his determination of the specimen used is correct, it has a second oblique but indistinct angular line from the costa to the inner margin, almost parallel to the line described by Blanchard (1852) in his description. Additionally, Butler (1882) added a sketch of the species for easier future determination. Finally, Scoble (1999) included it in the genus *Digonis*. However, the analysis of the type material reveals that the specimens determined as *Ennomos cervinaria* by Butler (1882) and subsequent authors are not congruent with the holotype of *Ennomos cervinaria* Blanchard. The external characteristics and genitalia of *Ennomos cervinaria* correspond to those of *Digonis cuprea* and its varieties, so these are synonymized.

The analysis of specimens incorrectly determined as *E. cervinaria* by Butler reflects a morphological correspondence with the concept of "Nacophorini" (sensu Rindge 1973, 1983), which brought together the Ennominae with a broad and "hairy" thorax that now form parts of the tribes Euangeronini, Odontoperini, and Nacophorini in part (Brehm et al. 2019). The most characteristic feature in the male genitalia corresponds to the row of spicules in the sagittal plane of the gnathos and the trifid, strongly sclerotized posterolaterally directed process of the anellus. This form and configuration of the gnathos are present in the genera *Euangerona* Butler and *Dectochilus* Butler; however, the process of the anellus is not congruent with both genera or any other Euangeronini, which show a process of the anellus pointing anteriorly and a highly developed setose socius (possible synapomorphies of the tribe). On the other hand, it shares with *Mallomus* Blanchard the spine-shaped form of the anellus process; however, in *Mallomus*, it appears as a single sclerotized spine, and the valvae have various modifications absent in *Gugnelve* gen. nov. such as a membranous harpe and digitiform processes on the cucullus. It was also not possible to assign this species to any of the Nacophorini genera in southern South America treated by Rindge (1973, 1983), Pitkin (2002), Parra and Pascual-Toca (2003), or Parra (2018). For this reason, *Gugnelve butleri* Ramos-González & Parra, gen. et sp. nov. is provisionally included in the Nacophorini.

Finally, this revision will serve as the basis for future molecular phylogenetic analyses that will help clarify the evolutionary relationships among species and related taxa. With this work, the number of Ennomini species present in Chile increases to 36 (Parra et al. 2009; Bocaz et al. 2016; Brehm et al. 2019), and the Nacophorini to 20 (Pitkin 2002; Brehm et al. 2019). These numbers are likely to increase in the future, considering that there have been few taxonomic revisions of Ennominae in the Andean region so far.

Acknowledgements

We would like to express our gratitude to M.J. Scoble and L. Pitkin (NHMUK) for their assistance during L.E. Parra's visit to the Natural History Museum. We also thank the staff at MHNC for their help during M.R.-G.'s visits. Our thanks extend to Joël Minet (MNHN) and Mario Elgueta (MNNC) for their cooperation in allowing the study of specimens deposited in their institutions. We are grateful to Axel Hausmann (ZSM) for sharing data and permitting the use of photographs of some specimens from the collection. We also acknowledge the support of the staff at the Museum of Zoology at the Universidad de Concepción, Chile (MZUC-UCCC) during the study of specimens. Additionally, we extend our sincere gratitude to Claudio Maureira, Flor Susana, Luis Chavarriga, Fpizarro, Antonio Maureira Navarrete, Ricardo Huenuanca, Michael Weymann, and Waldo Moyano for their contributions to the iNaturalist platform, particularly in observations of *Digonis* species. We extend our gratitude to Fundación Mongen (Chile) for sponsoring and supporting the field campaign in Las Cascadas (Los Lagos, Chile) during May 2023, which enabled the recording of a *Digonis* species. Thanks to Carolina Rose and Mario Ramos San Martín who collaborated in the field collection of specimens in Chiloé. M.R.-G. and C.Z.-M. acknowledge financial support from the "Beca Doctorado Nacional" ANID No. 21210517 and CONICYT No. 21161423, respectively.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

This research was supported by the Vicerectoría de Investigación y Desarrollo at the Universidad de Concepción (VRID 214.113.087-1.0).

Author contributions

Conceptualization: LEP, MFVG, MIRG. Data curation: MIRG, MFVG, CZM. Funding acquisition: LEP. Investigation: MIRG. Methodology: MIRG. Project administration: MIRG. Resources: MFVG. Supervision: LEP. Visualization: CZM, MIRG. Writing - original draft: MIRG, CZM, MFVG, LEP. Writing - review and editing: CZM, MFVG, MIRG, LEP.

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Data availability

All of the data that support the findings of this study are available in the main text.

References

Angulo AO, Casanueva ME (1981) Catálogo de los lepidópteros geométridos de Chile (Lepidoptera: Geometridae). Boletín de la Sociedad de Biología de Concepción (Chile) 51: 7–34.

Bartlett-Calvert W (1886) Catálogo de los lepidópteros Rhopalóceros i Heteróceros de Chile. Anales de la Universidad de Chile 69: 314–352.

Beljaev EA (2006) A morphological approach to the Ennominae phylogeny (Lepidoptera, Geometridae). Spixiana 29(3): 215–216.

Beljaev EA (2008) A new concept of the generic composition of the geometrid moth tribe Ennomini (Lepidoptera, Geometridae) based on functional morphology of the male genitalia. Entomological Review 88(1): 50–60. https://doi.org/10.1134/S0013873808010089

Blanchard E (1852) Fauna Chilena. Insectos. Orden VI. Lepidópteros. In: Gay C (Ed.) Historia física y política de Chile. Imprenta de Maulde et Renou, Paris, 1–112.

Bocaz P, Parra LE (2005) Revisión y bionomía del género *Syncirsodes* Butler, 1882 (Lepidoptera: Geometridae). Revista Chilena de Historia Natural 78: 89–111. https://doi.org/10.4067/S0716-078X2005000100007

Bocaz P, Sepúlveda-Zuniga E, Zamora-Manzur C, Parra LE (2016) Filogenia del género *Syncirsodes* (Lepidoptera: Geometridae). Revista Colombiana de Entomología 42(1): 75–80. https://doi.org/10.25100/socolen.v42i1.6673

Brehm G, Murillo-Ramos L, Sihvonen P, Hausmann A, Schmidt BC, Õunap E, Moser A, Mörtter R, Bolt D, Bodner F, Lindt A, Parra LE, Wahlberg N (2019) New World geometrid moths (Lepidoptera: Geometridae): Molecular phylogeny, biogeography, taxonomic updates and description of 11 new tribes. Arthropod Systematics & Phylogeny 77(3): 457–486. https://doi.org/10.26049/ASP77-3-2019-5

Butler AG (1882) Heterocerous Lepidoptera collected in Chili by Tomas Edmonds, Esq. Part III–Geometrites. Transactions of the Entomological Society of London 30(3): 339–427. https://doi.org/10.1111/j.1365-2311.1882.tb01580.x

Chalup A (2020) The biodiversity of the family Geometridae for Argentina. In: Juñent SA, Claps LE, Morrone JJ (Eds) Biodiversidad de artrópodos argentinos. Vol. 4. INSUE-UNT Ediciones, San Miguel de Tucumán, Argentina, 47–62.

Gajardo R (1994) La vegetación natural de Chile: Clasificación y distribución geográfica. Editorial Universitaria, Santiago, Chile, 165 pp.

Gaston KJ, Scoble MJ, Crook A (1995) Patterns in species description: a case study using the Geometridae (Lepidoptera). Biological Journal of the Linnean Society 55: 225–237. https://doi.org/10.1111/j.1095-8312.1995.tb01061.x

Guenée MA (1858) Histoire naturelle des insectes; spécies généraldes lépidoptères. Vol. 10 Uranides et Phalénites. Librairie Encyclopédique de Roret, Paris, 584 pp.

Hausmann A, Parra LE (2009) An unexpected hotspot of moth biodiversity in Chilean northern Patagonia (Lepidoptera, Geometridae). Zootaxa 1989: 23–38. https://doi.org/10.11646/zootaxa.1989.1

Holloway J (1993) The moths of Borneo, part 11: Family Geometridae, subfamily Ennominae. Malayan Nature Journal 47: 1–309.

Klots AB (1970) Lepidoptera. In: Tuxen SL (Ed.) Taxonomist's glossary of genitalia in insects, 115–130. Second Enlarged Edition. Munksgaard, Copenhagen, 359 pp.

Luebert F, Pliscoff P (2018) Sinopsis bioclimática y vegetacional de Chile. 2nd edn. Editorial Universitaria, Santiago, Chile.

Morrone JJ (2015) Biogeographical regionalisation of the Andean region. Zootaxa 3936(2): 207–236. https://doi.org/10.11646/zootaxa.3936.2.3

Õunap E, Javoiš J, Viidalepp J, Tammaru T (2011) Phylogenetic relationships of selected European Ennominae (Lepidoptera: Geometridae). European Journal of Entomology 108(2): 267–273. https://doi.org/10.14411/eje.2011.036

Parra LE (1991) Revisión y filogenia del género *Pachrophylla* Blanchard, 1852 (*sensu auctorum*) (Geometridae: Larentiinae: Trichopterygini). Gayana Zoología (Chile) 55(2): 145–199.

Parra LE (1999a) Revision of the Neotropical genus *Psilaspilates* (Lepidoptera: Geometridae). Annals of the Entomological Society of America 92: 460–472. https://doi.org/10.1093/aesa/92.4.460

Parra LE (1999b) Revisión del género *Euclidiodes* Warren, 1895 (Lepidoptera: Geometridae). Revista Chilena de Historia Natural 72: 643–659.

Parra LE (2018) A new genus of Nacophorini (Geometridae) from Chile. Journal of the Lepidopterologist Society 72(4): 265–269. https://doi.org/10.18473/lepi.72i4.a3

Parra LE, Henriquez-Rodriguez JL (1993) Aportes al conocimiento de las polillas del género *Mallomus* Blanchard, 1852 (Geometridae, Nacophorini). Boletín de la Sociedad de Biología de Concepción (Chile) 64: 171–187.

Parra LE, Hernández CE (2010) Estudio filogenético de los géneros de Lithinini de Sudamérica Austral (Lepidoptera, Geometridae): una nueva clasificación. Revista Brasileira de Entomologia 54(1): 1–27. https://doi.org/10.1590/S0085-56262010000100001

Parra LE, Pascual-Toca M (2003) Revisión taxonómica de los géneros *Oratha* Walker, 1863 y *Hasodima* Butler, 1882 (Lepidoptera: Geometridae). Revista Chilena de Historia Natural 76: 117–128. https://doi.org/10.4067/S0716-078X2003000100011

Parra LE, Vargas HA (2000) Revisión del género *Neorumia* Bartlett-Calvert, 1893 (Lepidoptera: Geometridae). Revista Chilena de Entomología 27: 91–98.

Parra LE, Villagrán-Mella R, Marquet PA (2009) Phylogeny of the genera *Euclidiodes* and *Hasodima* (Lepidoptera: Geometridae) and description of two new species from the Fray Jorge relict forest in northern Chile. Zootaxa 2273: 59–68. https://doi.org/10.11646/zootaxa.2273.1.3

Parra LE, Villagrán-Mella R, Hernández EA, Hernández CE (2010) Filogenia del género *Psilaspilates* (Butler 1893) (Lepidoptera: Geometridae) con la descripción de una nueva especie del bosque relicto Fray Jorge, Chile. Gayana 74(2): 94–101. https://doi.org/10.4067/S0717-65382010000200003

Pitkin LM (2002) Neotropical ennomine moths: a Review of the genera (Lepidoptera: Geometridae). Zoological Journal of the Linnean Society 135(2-3): 121–401. https://doi.org/10.1046/j.1096-3642.2002.00012.x

Rajaei H, Hausmann A, Scoble MJ, Wanke D, Plotkin D, Brehm G, Murillo-Ramos L, Sihvonen P (2022) An online taxonomic facility of Geometridae (Lepidoptera), with an overview of global species richness and systematics. Integrative Systematics 5(2): 145–192. https://doi.org/10.18476/2022.577933

Rindge FH (1973) Notes on and descriptions of South American Nacophorini (Lepidoptera, Geometridae). American Museum Novitates 2531: 1–42.

Rindge FH (1983) A generic revision of the new world Nacophorini (Lepidoptera, Geometridae). Bulletin of the American Museum of Natural History 175(2): 147–262.

Rindge FH (1986) Generic descriptions of new world Lithinini (Lepidoptera, Geometridae). American Museum Novitates 2838: 1–68.

Scoble MJ (1995) The Lepidoptera: Form, Function and Diversity. The Natural History Museum & Oxford University Press, London, 416 pp.

Scoble MJ (1999) Geometrid moths of the world: a catalogue (Lepidoptera, Geometridae). CSIRO Publishing. Natural History Museum, London, 1016 pp. https://doi.org/10.1071/9780643101050

Scoble MJ, Hausmann A (2007) Online list of valid and available names of the Geometridae of the World. Lepidoptera Barcode of Life. https://www.lepbarcoding.org/geometridae/species_checklists.php [accesed on 15 Feb 2022]

Vargas HA (2007) Dos nuevas especies de *Iridopsis* Warren (Lepidoptera, Geometridae) del norte de Chile. Revista Brasileira de Entomologia 51(2): 138-141. https://doi.org/10.1590/S0085-56262007000200003

Vargas HA (2021) *Iridopsis socoromaensis* sp. n., a geometrid moth (Lepidoptera, Geometridae) from the Andes of northern Chile. Biodiversity Data Journal 9: e61592. https://doi.org/10.3897/BDJ.9.e61592

Vargas HA, Parra LE, Hausmann A (2005) *Macaria mirthae*: una nueva especie de Ennominae (Lepidoptera: Geometridae) de Chile. Neotropical Entomology 34(4): 571-576. https://doi.org/10.1590/S1519-566X2005000400006

Vargas HA, Hausmann A, Parra LE (2020) A new species of *Macaria* Curtis (Lepidoptera: Geometridae: Ennominae) from the Andes of northern Chile. Revista Brasileira de Entomologia 64(2): e20200016. https://doi.org/10.1590/1806-9665-RBENT-2020-0016